THE GREAT ASSAM EARTHQUAKE OF 15TH AUGUST 1950

ON the evening of the 15th August 1950, about forty minutes past seven, an earthquake of catastrophic violence occurred off the north-east border of Assam. The earthquake was recorded by the seismological observatories all over the world as a very great earthquake and various adjectives such as tremendous, very violent, unprecedented, biggest ever recorded, have been used to describe the magnitude of the earthquake. It is one of the biggest ever recorded. Seismologists of the United States of America consider it as one of the five biggest in human history. The magnitude of the shock, as calculated by them, was between 8·25 and 8·5, the highest ever calculated so far being 8·5. Reports of damage from North and East Assam which gradually came through the press show that an area nearly 15,000 square miles in North and East Assam including subdivisions of North Lakhimpur, Dibrugarh, Jorhat, Tinsukhia, Sadiya and Sibsagar and the tribal areas of Abhor and Mishmi hills have suffered heavy damage. The loss of property in these areas has been stated to be nearly 10 crores of rupees. Fortunately the earthquake occurred at a time when people were awake and hence the loss of life has been very small in comparison with the magnitude of the shock.

The earthquake was accompanied with all the usual surface effects. Large fissures in the ground on an extensive scale have been reported from the affected areas through which enormous quantities of sand and water have been forced out, thereby spoiling the standing crops in the fields. In many places the ground has been reported to have subsided by several feet and a few swamps have been elevated. The natural drainage of the country has thus been affected. Railway tracks have been damaged around Dibrugarh and a few road and railway bridges are reported to have been rendered unusable. Landslides in the Abhor and Mishmi hills have occurred on a large scale, blocking innumerable small streams which in due course will give way and cause floods in their lower courses. Some big rivers like Dihang and Subansari were also blocked by large land slides. These artificial barriers have now burst and the water stored up is causing floods in the river Brahmaputra.

The shock was felt throughout North-East India, as far as Banaras to the west. It is also reported to have been felt at Rangoon in the south.

DETERMINATION OF THE EPICENTRE OF THE EARTHQUAKE

The epicentre of the shock was determined by the Seismological Observatory at Poona with the help of data obtained from the Indian seismological stations at Bombay, Calcutta,

Hyderabad, Kodaikanal and New Delhi. The Observatory at Poona is equipped with the latest types of seismographs which include the Benioff vertical seismograph, the Sprengnether electromagnetic horizontal component seismograph, the I. Met. D. pattern torsion seismograph and the Milne-Shaw seismograph. The other Indian observatories are mostly equipped with Milne-Shaw seismographs, the I. Met. D. pattern torsion seismograph and the Omori-Ewing seismographs. Poona seismograms of
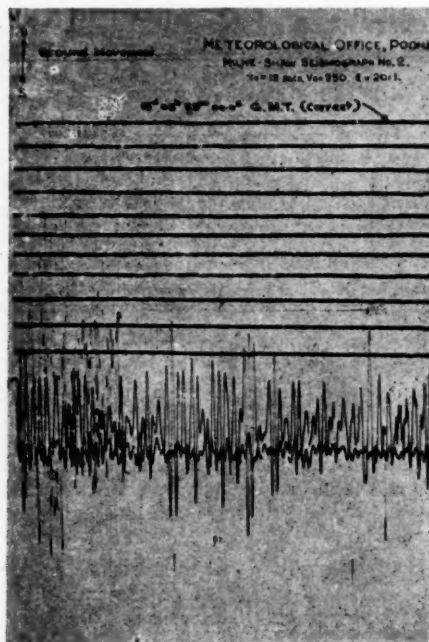

FIG. 1

the earthquake are shown in Figs. 1 and 2. Relevant phases which can clearly be distinguished are also shown. In this connection, it may be mentioned that due to the violence of the shock only the preliminary phases, and the beginning of the secondary phases could be recorded at most of the Indian stations. The surface waves which are the largest in amplitude, and which are mainly responsible for causing damage at places away from the epicentre, could not be recorded by any of the sensitive seismographs.

The corrected times of arrival of the P and S phases of the shock at the Indian seismological observatories in G.M.T. and the distances of the epicentre from them are given in Table I.

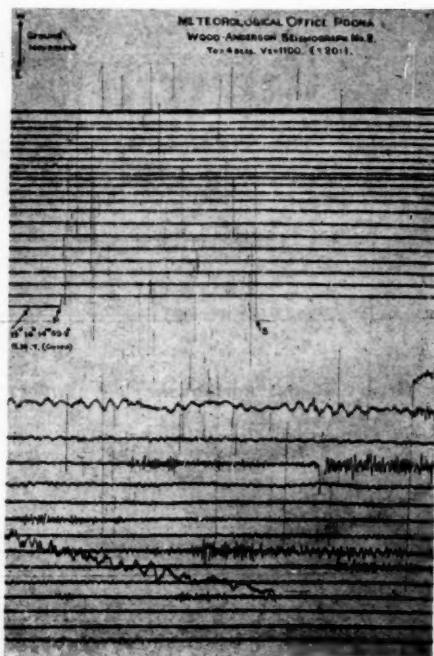With the help of the data the epicentre

FIG. 2

TABLE I

Station	P			S			Distance from origin (in miles)
	h	m	s	h	m	s	
Bombay	14	14	48	..	..	..	1690
Calcutta	14	11	50	..	..	..	690
Hyderabad	14	14	05	..	..	..	1400
Kodaikanal	14	15	03	..	..	..	1840
New Delhi	14	13	26	..	..	..	1200
Poona	14	14	36	14	18	48	1630

of the shock was located at Lat. 29° N. and Long. 97° E., about 30 miles from the northeast border of Assam. The origin time of the shock was calculated as $15^h 39^m 23^s$ I.S.T. or $14^h 09^m 23^s$ G.M.T. The reported time of arrival of the S phase by the Indian observatories was not found to agree closely because of the difficulty in recognizing the S phase clearly, due to its getting mixed up with the coda of the main shock and the vibrations of the subsequent after-shocks. In calculating the epicentre, the times of arrival of the P and S phases at Poona and the time of arrival of the P phase at the other observatories could only be taken into

consideration. The determination of the epicentre is, however, in good agreement with that of the Coast and Geodetic Survey of the United States of America who have located it provisionally at Lat. 28½° N. and Long. 97° E. near India, Burma, China Border.

The earthquake was followed as usual by a number of after-shocks which are still continuing in the affected region. Some of the after-shocks have been fairly strong and have caused further damage in the affected region. The after-shocks are originating from a large region around the epicentre, but mainly to the north and west of it.

NATURE OF THE SHOCK

A perusal of the seismograms shows that large surface waves were recorded at all distant stations showing that the origin of the earthquake is not deep seated and is confined within a few miles below the earth's surface. The nature of the damage with respect to the position of the epicentre also corroborates the same. The question has been raised as to whether the origin of the earthquake could be attributed to a volcano which had been lying dormant. A study of a number of earthquakes of volcanic origin in Japan shows that local earthquakes are felt in advance, which increase in frequency and intensity till the eruption of the volcano and then decrease rapidly afterwards. Also earthquakes of volcanic origin are shallow and their destructive effects are confined to within a few miles of the volcano and they are not recorded by seismographs beyond 50 to 100 miles. Even the tremendous volcanic explosion of Karakatoa Island in 1883 did not produce any noticeable seismic disturbance a hundred miles away.

In the case of the present earthquake destruction has been caused at distances of 150 to 200 miles, it has been recorded by seismographs all over the world, it was not preceded by any noticeable shocks, and was followed by a large number of after-shocks, which are still continuing. It is therefore clear that the present great earthquake cannot be due to a volcano and is of purely tectonic origin. Its ultimate causes are linked up with the geological history of the formation of the great Himalayan mountains which are undergoing changes and are said to be still rising.

EARTHQUAKES IN ASSAM

Not much is known about the earlier seismic history of Assam. This is due not to the absence of earthquakes in that region but to lack of information from these areas in earlier times. A fairly good account of the destructive

earthquakes which occurred in Assam is available from about the middle of the 19th century. R. D. Oldham did pioneer work in seismology and laid the foundation of seismological work in India.

Geologically, the region now called the State of Assam has been regarded as very unstable. As a matter of fact, Montessus de Ballore has called it as one of the most unstable regions in the world. It is therefore no wonder that this region has been the scene of nearly a dozen major earthquakes during the last century. These include the great Assam earthquake of 12th June 1897, which is regarded as the greatest earthquake in human history.

In Fig. 3 the epicentres of the earthquakes in Assam and the surrounding areas from

EPICENTRES OF EARTHQUAKES
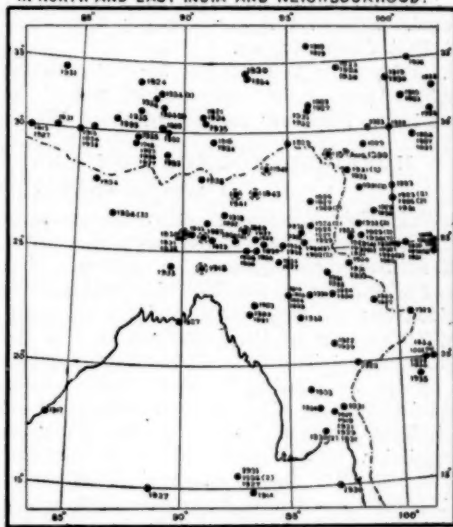IN NORTH AND EAST INDIA AND NEIGHBOURHOOD.

FIG. 3

1913-35 are plotted along with the year of occurrence. A list of destructive earthquakes in Assam with brief descriptions from 1869 to 1950 is given below, and the epicentres are also shown in Fig. 3.

LIST OF IMPORTANT EARTHQUAKES IN ASSAM

1. 1869, January 10. Assam (Cachar), Felt over an area of 250,000 sq. miles, the epicentre being on the north-east side of the Shillong plateau. Earth fissures and sand craters were very abundant.

2. 1897, June 12. Assam. Probably the greatest earthquake that has occurred anywhere during historic times. Felt over an area of 1,750,000 sq. miles with the epicentre in the Shillong plateau. Destruction of stone buildings almost universal in Shillong, Goalpara, Gauhati, Nowgong and Sylhet. Calcutta was seriously affected. About 1,600 lives lost. Followed by a great train of after-shocks continuing for 10 years.

3. 1918, July 8. Srimangal (Assam). Many tea estates ruined. Epicentre 3½ miles south of Srimangal on an Alluvial tract. Felt over an area of 800,000 sq. miles. Sympathetic shocks off the Madras and Arakan Coast.

4. 1923, September 9. Epicentre Lat. 25·5° N. and Long. 91·5° E. southwest of Assam. Some damage to structures near epicentral region over West Assam and northern part of East Bengal. Felt over Assam, Bengal, East Bihar and East Chota Nagpur.

5. 1930, July 3. Epicentre 25·8° N., 90·2° E. Dhubri, Assam, near north-western end of the Garo hills. Felt over an area of about 350,000

sq. miles. No loss of life but a few slightly injured. Followed by a large number of after-shocks.

6. 1932, August 14. Epicentre 25·8° N., 95·7° E. in N.W. Burma. Focal depth about 130 kms. Semi-destructive near the epicentral region and some damage over eastern part of North-East Assam. Felt over Assam, Bengal and North Burma.

7. 1941, January 21. Epicentre 27·5° N., 92·5° E. in North Assam. Felt over Assam and North and East Bengal. Some damage near the epicentre.

8. 1943, October 23. Epicentre 27·5° N., 93·5° E. in Assam. Destructive over North-East Assam and minor damage over northern part of Assam. Felt over Assam, Bengal, and major parts of Bihar and North-East Orissa.

9. 1947, July 29. Epicentre 28·5° N., 94° E. about 100 miles north-west of Dibrugarh. Damage to buildings in parts of North-East Assam. Felt over Assam, in Bengal up to Calcutta and in Bihar up to Purnea.

V. V. SOHONI.

NUFFIELD FOUNDATION TRAVELLING FELLOWSHIP AWARDS TO INDIAN GRADUATES

THE Nuffield Foundation, with the object of advancing the interests of India as a whole and further strengthening the academic ties between India and the United Kingdom, has decided to make available to India five Travelling Fellowships for the year from 1951-52. An Advisory Committee in India has been appointed by the Foundation to advise them on the administration of the scheme, consisting of Shri. Gaganvihari L. Mehta, Member, Planning Commission (*Chairman*), Shri. S. Varadachariar, Sir C. V. Raman and Shri. J. J. Ghandy. It has been decided to award the Fellowships for the year 1951-52 in the following subjects:

Two Fellowships in Medical Sciences, preference being given to candidates wishing to study: (1) Physiology or Bacteriology, and (2) Industrial Medicine or Public Health; one Fellowship in Engineering, preference being given to candidates wishing to study Electrical Engineering (Generation or Distribution); one Fellowship in Natural Sciences, preference being given to candidates wishing to study Plant Genetics or Soil Science, and one Fellowship in Social Sciences, preference being given to candidates wishing to study Industrial Relations or Personnel Management, and Agricultural Economics.

The purpose of the Fellowships is to enable Indian graduates of outstanding ability to gain experience and training in the United King-

dom in their chosen fields, and to make contact with scholars working in those fields, with a view to the Fellows equipping themselves to take up senior posts in research and teaching in India.

The candidates, men or women, must be Indian nationals, normally between the ages of 25 and 40 years, and must be university graduates holding, preferably, a Master's or Doctor's degree, and having subsequently had a year or more of teaching or research experience on the staff of a university or comparable institution.

It is estimated that the total value of an award (exclusive of travelling expenses) will be at the rate of from £770 to £890 a year (sterling), according to individual circumstances. In addition, the Foundation will pay the travelling expenses to and from the United Kingdom of a Fellow's wife, if he is married at the time he makes his application, in those cases in which the Advisory Committee agrees to a Fellow being accompanied by his wife.

Applications for Fellowships to begin in 1951 should be submitted not later than the 31st March, 1951, to the Secretary, Nuffield Foundation Indian Advisory Committee, c/o Planning Commission, Government House, New Delhi, from whom copies of the form of application may be obtained.

A PAPYROGRAPHIC MICRO-METHOD FOR A DETERMINATION OF THE ORGANIC ACID MAKE-UP OF FERMENTED BEERS

V. S. GOVINDARAJAN AND M. SREENIVASAYA

(Section of Fermentation Technology, Indian Institute of Science, Bangalore-3)

IN the course of our studies on the fermentative production of organic acids by various types and strains of fungi, maintained in the National Collection of Type Cultures, India, we were confronted with the problem not only of screening them with respect to their overall acid-producing capacity, but also of determining the organic acid make-up of the beer obtained by fermenting a standard sugar medium with each one of the fungal cultures.

The encouraging success which attended our studies on the papyrographic separation and characterisation of amino acids in micro quantities of protein hydrolysates [1] suggested the possibility of adapting this technique for a study of organic acids in fermented beers.

Preliminary experiments revealed that unlike amino acids, organic acids when run on the phase-pairs like water/n-butanol, were found to leave long diffuse tails behind the heads and the excursions were found to decrease with a fall in the concentration of the acids in the original solution. Lugg and Overell[2,3] attribute these effects to the ionisation of the acids in the aqueous phase and their adsorption by the filter paper. They have worked out the conditions under which discrete separations of organic acids could be secured, by incorporating a volatile acid in the mobile phase, which suppresses the ionisation of the other acids and displaces them from the filter paper by competitive adsorption. Acetic and formic acids have been employed as the volatile constituent of the mobile phase. In our studies we have adopted this modification to a micro-scale with excellent results.

EXPERIMENTAL

For single samples, the test tube microtechnique described earlier[1] was followed. When, however, a number of samples had to be analysed, as for instance, when a comparative study of the organic acid make-up of beers produced by different types of fungi, had to be made, the samples were simultaneously run on the same sheet of paper under identical conditions. This was accomplished by spotting the different samples on the filter paper, which, after drying and rolling into a cylinder, could be made to stand without any support. The vessel used consists of an ordinary cylindrical diet jar (10 cm. dia × 20 cm. ht.) provided with a ground-glass cover, which could be sealed airtight by means of an adhesive tape. The solvent was prepared by shaking up equal volumes of distilled water, n-butanol and an adequate amount of acetic acid to yield initially a 2-3 moles solution in the aqueous phase. The phases separate within a short time.

The aqueous phase is placed at the bottom of the jar while the butanol-acetic phase is kept in a petri-dish cover placed at the bottom. The filter paper (19 cm. × 18 cm.) was spotted with the test samples at points 2 cm. apart and in a line about a centimetre high from the lower edge of the paper. Quantities of the test beer varying from 0·001 to 0·005 ml. are delivered on to the spot by means of capillary pipettes. Care is taken to see that the diameter of the spot does not exceed 3-4 mm. After drying, the paper is rolled into a cylinder, "bosstitched" and hung for a couple of hours in the cylinder without dipping into the solvent; during this period, the filter paper gets itself saturated with the aqueous and volatile solvent vapours. The cylinder is then lowered into the centre of the petri dish containing the mobile phase. The run usually takes about five hours at the room temperature (24-25° C.) with the n-butanol-acetic as the mobile solvent.

After the run, the filter paper cylinder is air-dried over night and then passed through an oven at 60° C. for 5-10 minutes. The cylinder is then unrolled and treated with an alcoholic solution of brom-cresol green (40 mgm. per cent. in 95 per cent. alcohol) either by spraying or by dipping. The positions occupied by the acids are revealed as yellow spots against a greenish blue back-ground. (See Figs. 1 to 4 which represent faithful reproductions of the papyrograms.)

DISCUSSION

Fig. 1 shows that a mixture of the six acids, each of them being present at the level of 10 γ in the test spot, can be separated into discrete spots on the papyrogram. The excursion of a given acid is definitely influenced by the presence of another acid. It is, therefore, clear that the R_F values have little significance so far as the reading of the papyrograms of mixtures

are concerned. The relative positions occupied by the different acids from a mixture remain fortunately constant for any given phase pair. If, therefore, a known mixture of pure organic acids (reference mixture) is simultaneously papyrogramed along with the test mixture (*e.g.*, fermented beer) the spots of the reference mixture will serve to interpret the spots of the test fluid.
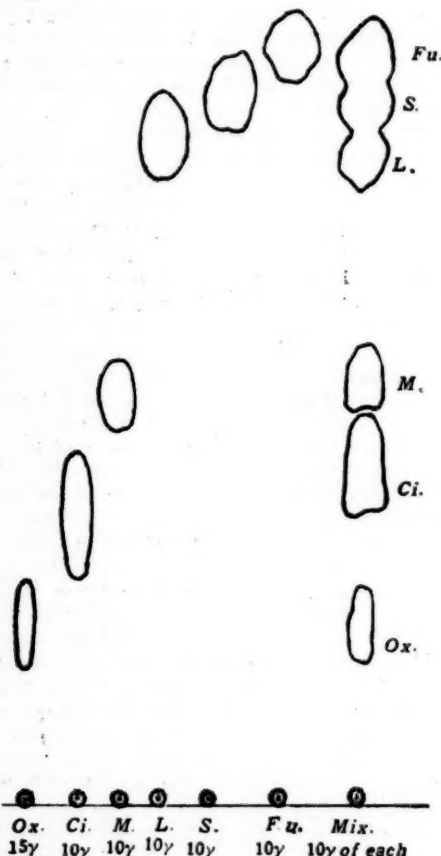
the acid spot with a series of standard reference spots (see Fig. 2) obtained by papyrograming known quantities of the acid under
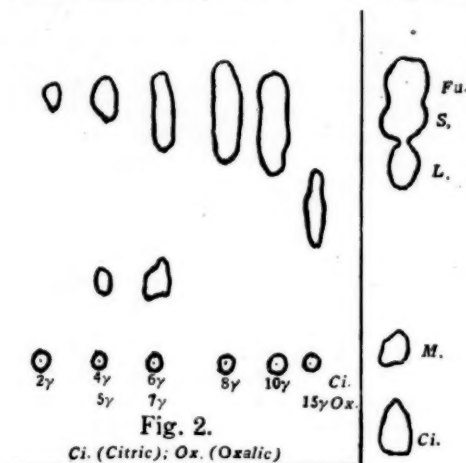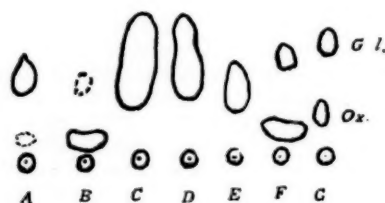

Fig. 2.

Ci. (Citric); *Ox.* (Oxalic)

Fig. 3.

Papyrogram of Beers Fermented by Fungi.
A. oryzae—A : at initial pH 2 and B : at initial pH 6·8.
A. mucer—C: at initial pH 2 and D : at initial pH 6·8.
A. penicillium--E: at initial pH 2 and F: at initial pH 6·8. *F*: Reference Mixture of Organic Acids ; *Gl.* (Gluconic).

Fig. 1.

Papyrogram of Individual and Mixture of Organic Acids. Abbreviations : *Ox.* (Oxalic) ; *Ci.* (Citric) ; *M.* (Malic) ; *L.* (Lactic) ; *S.* (Succinic) ; *Fu.* (Fumaric).

Figs. 1 and 2 show that except for oxalic and citric acids which yield elongated spots, the other acids appear as circular spots. By keeping the size of the intitial test spots nearly constant, it is easy to obtain a semiquantitative idea of the relative concentration of a given acid in the mixture, by comparing the size of

the same conditions. Such estimations are obviously permissible and limited only to a certain well-defined range of acid concentrations. Quantities higher than 10-15 γ of each acid in the starting spot introduce complications in this micro-method. Lactic, succinic and fumaric acids, whose spots are closely situated, tend to merge into a continuous spot but remain distinctly discernible by the bulbular form of the spot.

Overloading the test spot with a heavy concentration of the mixture, will result in a continuous patch; the presence of a relatively high concentration of a single acid in the test mixture will give an elongated spot enveloping the spots produced by the acids which occupy

the nearby positions. This is illustrated in Fig. 4 where the beer fermented by a strain of *Aspergillus niger,* a high citric acid yielder, is papyrogramed. The sample contains about 70 mgm. of citric acid per ml. of the beer, and 0·001 ml. of the beer was spotted. The citric acid spot is seen to cover the malic acid position also.
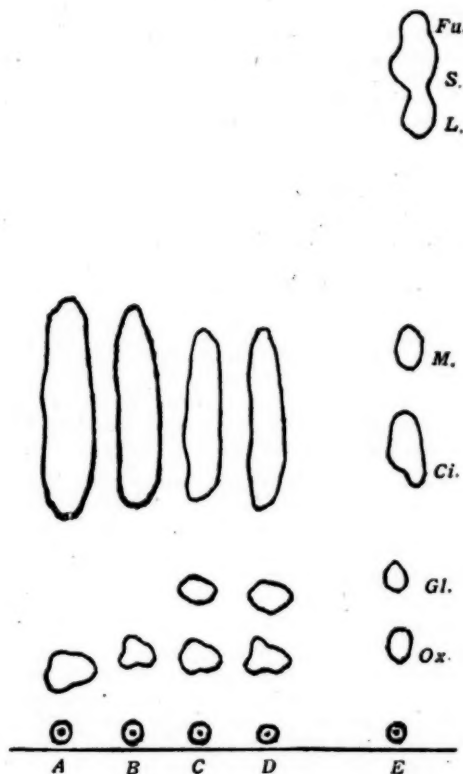
bio-chemical performance of fungi as a factor in their characterisation has not been extensively recognised probably because of the lack of suitable, reproducible and rapid methods of estimation. It is believed that the acid-producing capacity both in its qualitative and quantitative aspects might serve to characterise certain groups of fungi and distinguish certain strains of a particular type of organism. The papyrographic method which we have developed for characterising the acids, might be one such method which has the merit of (*a*) rapidity, (*b*) reproducibility, (*c*) simplicity and elegance, (*d*) ease of manipulation and (*e*) adaptability to micro quantities.

We have explored this possibility, by taking a few types and strains of fungi, growing them in a standard medium and subjecting the resulting beers to a papyrographic analysis. Two different hydrogen-ion concentrations, pH 2·0 and pH 6·8 have been chosen for these studies. The results are presented in Figs. 3 and 4.

From a study of the position and intensity of the spots it was found that the strain of *A. niger* produces large qualities of citric acid and traces of oxalic and gluconic acids. Beers fermented at pH 6·8 contain a smaller quantity of citric acid while a definite increase in the quantity of oxalic acid and gluconic acids is indicated.

The penicillium yields appreciable amount of oxalic and traces of gluconic acids at the neutral pH while with initial acid pH only gluconic acid is obtained.

A. oryzœ give appreciable quantities of gluconic acid with initial acid pH and appreciable quantity of oxalic acid and traces of gluconic acid with the initial pH at 6·8, while the mucor has been found to form gluconic acid in appreciable amounts at both the pH. These results have clearly demonstrated that a considerable amount of data with respect to the acid-producing capacity of fungi could be obtained by this simple and elegant method of analysis. As suggested by Lugg and Overell,[2,3] the spots could be excised, the acid extracted by steeping them in water and titrated. We can thus obtain a quantitative data.

The applications of this method are many; it offers a convenient method for making a comparative study of the acid-producing efficiency of the various mutants resulting by the irradiation or chemical treatment of a given fungus. The variation in the organic acid make-up of beers fermented under different experimental conditions—effect of temperatures, pH,

Fig. 4.

Papyrogram of Beer Fermented by *A. niger* 46–11.
  A and B : with an initial pH 2.
  C and D : with an initial pH 6·8.
  E : Reference Mixture.

At the moment, the taxonomic classification of fungi is largely based on morphology while in the case of bacteria and yeasts, the classification takes into account the bio-chemical activities of the organisms. The fermentability of different types of sugars, for instance, has been extensively employed for the characterisation of bacteria and particularly yeasts. The

trace elements, atmospheres, concentration of various nutrients and forms of carbon and nitrogen—can be determined.

SUMMARY

A papyrographic micro-method for the separation, characterisation and semi-quantitative determination of the non-volatile organic acids in a mixture of them, is described.

The method is characterised by its simplicity, elegance, rapidity and ease of manipulation and has been shown to be adaptable to micro quantities of test samples.

The applicability of this method for a determination of the organic acid make-up of beers fermented by fungi has been demonstrated. The employment of this method as a helpful routine for a taxonomic characterisation of fungi, for evaluating the comparative acid-producing efficiency of different types, strains and mutants of fungi, and for a study of the optimum conditions favouring the production of a given acid, is suggested.

Further, the method offers possibilities in the detection of intermediates[4] and new acids formed during fermentation of carbohydrates just as the papyrographic method helped in the detection of new amino acids.

1. Govindarajan, V. S., and Sreenivasaya, M., *Curr. Sci.*, 1950, **19**, 39. 2. Lugg, J. W. H., and Overell, B. T., *Nature*, 1947, **160**, 87. 3. —, *Aust. J. Sci. Res.*, 1948, **1A**, 98. 4. *Added in proof:* Use of buffered solvent and application to study of path of carbon in photosynthesis in given by Benson, A A., *et. al. J. Amer. Chem. Soc.*, 1950, **72**, 1710.

CENTRAL GLASS AND CERAMIC RESEARCH INSTITUTE

THE Central Glass and Ceramic Research Institute which was opened by the Hon'ble Dr. B. C. Roy, Chief Minister of West Bengal, during the last week of August at Calcutta, constitutes the fourth in the chain of National Laboratories and will satisfy a longfelt need. Even in 1918, the Indian Industrial Commission had recommended the setting up of such an Institute. During World War II, the need for the Institute was felt even more acutely. In 1942, the Government of India approved the establishment of the Institute and a Committee with Dr. S. S. Bhatnagar, Director, Scientific and Industrial Research, as Chairman, was appointed to prepare the plans. The proposals of the Committee were approved by the Governing Body of the Council of Scientific and Industrial Research in 1944 and a sum of Rs. 12 lakhs was sanctioned towards capital expenditure. The construction of the technological block commenced in 1945 and technical work has been going on there since 1948. But it was only in December 1945 that the late Shri. Ardeshir Dalal, the then Member of the Viceroy's Executive Council for Planning and Development, laid the foundation-stone of the main building. Actual construction was, however, undertaken only after additional funds were sanctioned in September 1948. The Institute will conduct fundamental research having a bearing on the different branches of glass and ceramics. Its other functions will be testing and standardisation, technical assistance to the glass and ceramics industry, dissemination of information and training of technologists for special work. The scope of its work includes research and investigation in glass, pottery and porcelain, enamels and refractories.

Apart from fundamental research, an important function of the Institute will be to render technical help to the industry in the improvement of the quality of products and to induce the industry, by demonstrating the benefits of scientific processes, to utilize and adopt improved techniques in works operations. In the course of time, the Institute will encourage the factories to send their workers for short training courses so that they may apply the knowledge so gained in manufacturing operations. Research staff will also be sent to visit factories in order that they may acquire factory experience.

The Institute will work in collaboration with industry, universities, other research organisations and Government departments for the collection of data and the dissemination of technical information. For this purpose, the Institute will also maintain a library for the use of workers and will organise a museum where a wide collection of finished articles, samples of raw materials in various regions, processed raw materials and other items of interest to the industry, will be displayed.

LETTERS TO THE EDITOR

ON THE TEMPERATURE DEPENDENCE OF COUNTER CHARACTERISTICS IN SELF-QUENCHING G. M. COUNTERS

IN a previous communication the author[1] had reported about the temperature dependence of counting rate *vs.* voltage curves in self-quenching G. M. Counters with external (denoted as A) and internal (denoted as B) cathodes within the temperature range 9°-60° C. It was shown that the plateau disappeared at lower temperatures while at higher temperatures (within the range investigated) there was

an increase in plateau slope together with a decrease in useful plateau range.

In a private communication to the author Mr. J. L. Putman* pointed out that the effect of temperature on the characteristic curve of a Geiger Counter may take either or both of the two forms:

(a) An increase (or sometimes a decrease) in the slope of the plateau as the temperature is raised;

(b) A progressive shift of the plateau bodily towards higher operating potentials as the temperature is raised;

3

and remarked that both the effects are irreversible and a counter does not at once revert to normal after cooling down. Also, that the relative magnitude of effects (a) and (b) were different in counters of different types, and these permanent effects occurred at rather higher temperatures (around 100° C.) than reported in my previous paper.

In order to observe the type of effects suggested by Mr. Putman, counter B of the previous communication was successively raised to higher temperatures through 20° steps (upto 180° C.) in a thermostatically controlled electric furnace ($\pm$ 0·5°C.) and the counting rate-voltage curves obtained at different temperatures. The counter remained at each of the higher temperatures for about 2 to 3 hours and after each heating it was slowly brought to the room temperature in about half an hour and the characteristic curve obtained again. Some of the curves are given in Fig. 1.
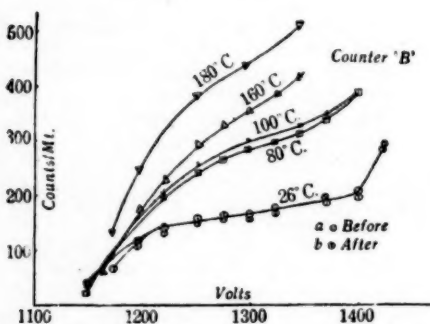
FIG. 1. Showing the counting rate-voltage curves at different temperatures. Two sets of points for the curve at 26°C. are (a) before the counter was put to test for this series of temperatures and (b) after this series was completed and the counter brought to the above temperature after 180°C. test. Curves obtained at 26°C. after each heating coincide with the given one and have been left.

It is found that even after the counter has been heated to 180° C., it regains its original characteristics exactly and immediately except for a slight permanent increase in the starting voltage (which appeared after 160° C.) which might be due to a slight increase in pressure inside the counter as some of the adsorbed gases might come out at higher temperatures. It is also seen that the plateau has disappeared and there seems to be a large increase in the counting rate at higher temperatures. Visual observations on the oscilloscope screen showed practically no change in the height of the pulse,

though multiple pulses appeared more frequently and with greater multiplicity at higher temperatures.

Thus, in our particular case, the effects mentioned by Mr. Putman do not occur. However, Holt (Atomic Energy Research Establishment, Harwell, England) has obtained some results on commercial counters filled with argon-alcohol mixture. For instance,

(i) The G.E.C. Type GM_1 counter had relatively little effect, showing only a general increase in the plateau level as the temperature was raised from 19-30° C., followed by a drop to the previous value at about 50° C., with little further change to 100° C.

(ii) The G.E.C. Type GM_2 of a similar shape but baked out differently showed a change of plateau position as for example, 1080-1340 volts at 11° C., 1080-1440 volts at 20° C., 1220-1500 volts at 45° C., 1280-1550 volts at 98° C.

(iii) An Eck and Krebs' silver cathode counter showed decrease in plateau length as the temperature was raised from 11°-48° C. and then an increase in length upto 90° C. at least. The threshold was not affected.

(iv) An all tools counter (B.L. No. 19) had a plateau from 760 -860 at 16°C., from 800-920 at 30° C. and from 860-1000 volts at 49° C. Above that the threshold voltage showed little change, but the general level of the plateau increased being about 10 per cent. higher at 68° C.

(v) A cinema Television GM_5 (copper cathode) counter did not come back to its original characteristics even after 24 hours (heated to 70° C.), the threshold remaining unaltered.

Holt[2] found these results to depend on the type of counter and not on the particular sample of the counter being used. Thus from the above discussion it appears that the temperature effect is different in different counters and that it must depend on the nature of the cathode. In our case, however, with oxidized copper cathode, the following change may occur at higher temperatures:

$$CuO-Cu_2O-Cu$$
$$C_2H_5OH-CH_3CHO-CH_3COOH$$
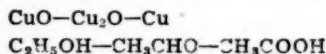
i.e., the alcohol finally got reduced to acetic acid and copper oxide (CuO) to cuprous oxide (Cu_2O) and then to copper. It was observed that some portions of the cathode turned pinkish from the original black, showing the occurrence of above type of reaction. Prolonged heating

should, therefore, show some effect on the life and properties of the counter.

Hence it seems necessary to test counters for their temperature dependence before using them in any standard work, especially when the counters are to pass through varying conditions of temperature, and as a precautionary measure to use a multi-vibrator circuit[3] to eliminate any such effects.

The author is grateful to Dr. H. R. Sarna, Director of the East Punjab University Physics Laboratories, Government College, Hoshiarpur, for his kind encouragement and facilities provided for this work.

E. P. Univ. Physics Labs.,   OM PARKASH.
Government College,
Hoshiarpur,
East Punjab (India),
May 24, 1950.

1. Om Parkash, *Phys Rev.*, 1949, **76**, 568. 2. Holt, F. R., "Private Communication." 3. Putman, J. L., *Proc. Phys. Soc. Lond.*, 1948, **61**, 312.

"JOSHI EFFECT" [1,2,3,4] IN IODINE VAPOUR UNDER X-RAYS

JOSHI[5] found a 17 per cent. decrease of the discharge current in chlorine consequent on irradiation with X-rays—a very powerful means of ionisation. He claims that such a remarkable behaviour has not been observed hitherto in the literature of the X-ray phenomenon. Hence it was of interest to extend these observations to iodine vapour. Out of numerous sets taken in these Laboratories [using a glass ozoniser of the Siemen's type and observing the current by a reflection type galvanometer (Gambrell) actuated by a Germanium Crystal Diode 1 N 34 Sylvania], one is reproduced below (see table).

The following important results emerge from the observations.

1. Joshi Effect, the almost instantaneous and reversible photo-diminution of electrical conductivity, is not observed on irradiation with X-rays. A photo-increase, i.e., a + effect, has been observed.

2. The conductivity contributed by X-rays remains unaffected when the ozoniser is exposed simultaneously to X-rays, and white light. $\% \Delta i$ recorded in the "Mixture" column is approximately an algebraic sum of $\% \Delta i$, recorded under X-rays and the white, e.g., at ·4 KV, the corresponding effects with X-rays, white and Mixture are +25, −50 and − 25 respectively.

The result No. (1) is the normal behaviour of the vapour on account of intense ionising properties of X-rays though apparently in direct contradiction to Joshi's findings[5] in chlorine. The most significant result is illustrated under (2) and can find a very easy explanation on R. Prasad's views[6] of the Joshi Effect, which suggest that the production of Joshi Effect originates from the dielectric component of the Total Current; the ionic or ohmic part of the discharge current is not affected by light. The X-rays contribute to increase the ohmic part of the current, which is not appreciably susceptible to light and hence the result. But Prasad's views are negatived by overwhelming results which are in accord with

Potential in KV (r. m. s.) 50 cycles	Current in dark i_D	X-rays irradiation (Discharge type bulb)				Whitelight irradiation 100W-230 lamp			"Mixture" Simultaneous irradiation		
		Current under irradiation i_L	$i_D - i_L = \Delta i$	$\frac{\Delta i}{i_D}100 = \% \Delta i$		i_L	$i_D - i_L = \Delta i$	$\% \Delta i$	i_L	Δi	$\% \Delta i$
·3	1	3·5	2·5	+ 250		·5	·5	− 50	3·5	2·5	+ 250
·35	4	7	3	+ 75		2	2	− 50	5	1	+ 25
·4	8	10	2	+ 25		4	4	− 50	6	2	− 25
·45	11	13	2	+ 19		6	5	− 45	8·5	2·5	− 22·7
·5	14·5	17	2·5	+ 16		10	4·5	− 31	12	2·5	− 17·1
·6	21·5	23·5	2	+ 9		20·5	1	− 5	22	·5	+ 2·3
·75	26	37	1	+ 3		35	1	− 3	36·5	·5	+ 1·3
·9	56	58	2	+ 3·5		55·5	·5	− ·9	56	0	0
1	75	78	3	+ 4		75	0	0	78	3	+ 4
1·25	151	156	5	+ 3·3		151	0	0	156	5	+ 3·3

Joshi's views, that the ohmic part of the discharge current is the main seat of the phenomenon.[7,8,9]

The result can be interpreted on Joshi's Theory, supported by the authors' views on the 'Velocity Spectrum' of the emitted photoelectrons from the adsorption layer, when exposed to radiations. Joshi's Theory contemplates three stages, viz., (i) an adsorption-like boundary layer is formed on the electrode surface under the applied field, (ii) photo-electric emission occurs from the layer and (iii) the photo-electrons are captured by the excited atoms and molecules to form slow-moving negative ions and produce the observed photo-diminution, as a space charge effect. When a radiation falls on the adsorbed layer, photoelectrons of various velocities (Velocity Spectrum) ranging from 0 and guillotined at

$$v = \sqrt{\frac{h\nu}{\frac{1}{2}m}}$$ are emitted. These electrons are

captured by the excited atoms which are themselves under various states of excitation (including the state of ionisation) at a particular exciting potential. Since atoms under different states of excitation have different electron affinity, the probability of all electrons being captured is maximum, if electrons with various velocities are emitted out from the adsorbed layer (subject to the nature, pressure, etc., of the gas) and hence the saturation-like effect for the white light.

In the present investigation, these photoelectrons bring about a certain decrease, when the ozoniser is exposed to white light. Similarly when the ozoniser is exposed to X-rays, a photo-increase of conductivity occurs due to intense ionisation of the bulk of the gas. The X-rays may also simultaneously emit photoelectrons from the adsorbed layer but the velocity spectrum will be guillotined at a very high value, and so the chances of electron-capture (and hence Joshi Effect) are smaller. Hence the Joshi Effect due to X-rays is bound to be less and may completely be masked by the intense ionisation resulting in a +ve effect. The probability of electron capture is conditioned by many factors, such as nature, pressure of the vapour or gas under investigation, intensity of irradiation, velocities of photo-electrons, etc. By suitably choosing the pressure and nature of the gas it may be possible to observe a Joshi Effect as has been observed by Joshi in chlorine at 26 cm. pressure. When the ozoniser is flooded with the "Mixture", the X-rays do their job of increasing the conductivity while the white light does its own (produce a photo-

diminution), hence the last column is the algebraic sum of the other two columns.

Our grateful thanks are due to Prof. Joshi for his kind interest and guidance.

Holkar College Labs.,   A. P. SAXENA.
Indore (Madhya Bharat),   P. K. KARMALKAR.
June 12, 1950.

1. Joshi, *Curr. Sci.*, 1939, **8**, 48. 2 —, *Pres. Address, Chem. Sec. Ind. Sci. Cong.*, 1943. 3. —, *B. H. U. Journal*, 1943, **8**, 99. 4. —, *Nature*, 1944, **154**, 147. 5. —, *Curr. Sci.*, 1944, **13**, 278. 6. Prasad, R., *Nature*, 1945, **155**, 362. 7. Joshi, *Curr. Sci.*, 1945, **14**, 67. 8. —, *Proc. Ind. Acad. Sci.*, 1945, **22A**, 293. 9. Tiwari and Prasad, *Curr. Sci.*, 1945, **14**, 229.

DIELECTRIC CONSTANTS OF CANE SUGAR

CANE sugar ($C_{12}H_{22}O_{11}$) belongs to the monoclinic sphenoidal class. It has b axis as the symmetry axis, and the crystallographic a axis is inclined at 103° 30' to the c axis. Angles in the (010) plane are taken positive when measured from c in the direction of the above obtuse angle. The optical ellipsoid has one of the principal axes inclined at $+66°$ 30' to the c axis. One of the principal directions of the electric susceptibility coincides with b axis, while the other two in the (010) plane are inclined to the crystallographic axes.

The principal dielectric constants of cane sugar are determined using sections from perfectly transparent colourless crystals by the liquid-mixture method[1] at a frequency of 1·6 megacycles and are given below together with those of previous investigators.

	K_1	K_3	K_b	ϕ
Author ..	3·85	3·53	3·56	$+12°$
Schmidt & Dubbert[2] ..	3·46	3·16	3·32	$-58°·7$

(ϕ is the angle between the direction of K_1 and c axis.)

In the direction $-60°$ to c, the author observed the dielectric constant to be 3·58 whereas in the direction nearly perpendicular to the (001) plane, the value is 3·85.

The squares of refractive indices extrapolated to infinite wavelength from the visible region are 2·34, 2·42 and 2·44. Hence the mean atomic polarisation of cane sugar comes out to be 32·2 per cent. of the total polarisation. This high value of the percentage of atomic polarisation in the case of cane sugar compared to 10 per cent. or less in the case of hydrocarbons as benzene, toluene, hexane, etc., is

not surprising in view of the presence of OH radicals in the molecule. The OH radicals are known to cause additional polarisation and the effect of their presence can be seen by comparing the atomic polarisation of solid Benzene[3] (C_6H_6)—$P_A \approx 3\cdot4$, and of solid phenol[4] (C_6H_5OH)—$P_A = 5\cdot5$. Similarly when we pass from propane[5] (C_3H_8) to glycerine[6] [$C_3H_5(OH)_3$] it has been found that the atomic polarisation increases. In the case of tartrates such as dipotassium tartrate, sodium ammonium tartrate, etc., and of alcohols in the solid condition, the dielectric constants are much higher than the squares of refractive indices leading to high percentage of atomic polarisation, and the OH radicals are known to be partly responsible for it.

The author wishes to thank Shri. B. C. Joshi, Cane Sugar Research Institute, Ravalgaon, for supplying the crystals.

D. A. A. S. NARAYANA RAO.
Andhra University,
Waltair (S. India),
July 8, 1950.

1. *Proc. Ind. Acad. Sci.* 1947, **25A**, 408. 2. *Lehrbuch. der Kristall Physik* (Voigt), 1910, 459. 3. *Jour. Phy. Chem.*, 1930, **34**, 2385. 4. *Jour. Amer. Chem. Soc.*, 1933, **55**, 462. 5. *Ibid.*, 1933, **55**, 453. 6. *Proc. Roy. Soc.*, 1936, **154A**, 138.

RAMAN SPECTRUM OF CADMIUM TUNGSTATE

VERY little work has been done so far on the Raman spectra of crystalline tungstates. The only reference in the literature on the subject is to a paper by Nisi[1] on the Raman spectrum of scheelite, $CaWO_4$. Recently, an artificially-grown single crystal of cadmium tungstate, supplied by the Linde Air Products Co., was made available to the author for studying its Raman spectrum. It was in the form of a square rod of size $20 \times 3 \times 3$ mm. and slightly yellowish in colour. The specimen was not quite transparent, as it had some inclusions in the middle. Its Raman spectrum taken with λ 4358 excitation from a water-cooled mercury arc and with a Fuess spectrograph is reproduced below. Although the specimen was found to be free from fluorescence, a more intense photograph of the Raman spectrum could not be obtained, since the scattering was very feeble. The recorded spectrum exhibits nine frequency shifts, the values of which are entered in Table I. Their positions have been marked in the figure. The degeneracies of ν_2, ν_3

and ν_4 are completely removed in the spectrum of crystalline cadmium tungstate (see Table I),

TABLE I

Substance	ν_1	ν_2 (2)	ν_3 3	ν_4 (4)
Na_2WO_4 in Solution(2)	934	325	840	452
$CaWO_4$ Scheelite	909	332	852 835 795	400
$CdWO_4$	898	389 309	838 775 699	545 500 464
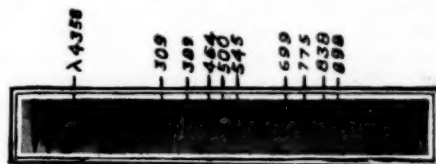
The Raman Spectrum of Cadmium Tungstate

indicating thereby that the symmetry of the crystal is very low. The lowering of the frequency of the symmetric oscillation ν_1 by about 35 cm.[-1] suggests that the influence of the cation on the WO_4 oscillation is considerable.

The author wishes to express his grateful thanks to Prof. R. S. Krishnan for his constant encouragement and guidance.

Physics Dept.,   V. CHANDRASEKHARAN.
Ind. Inst. of Science,
Bangalore 3,
August 22, 1950.

1. Nisi, *Zeeman, Verhandelingen*, 1935, p. 261.
2. Venkateswaran, C. S., *Proc. Ind. Acad. Sci.*, **A**, 1938, **7**, 144.

OCCURRENCE OF RADIO-ACTIVE COLUMBITE IN TRAVANCORE

LABORATORY tests on a grey black mineral which the author came across during his field investigations on a complex pegmatite at a place called Othara in Central Travancore, have revealed that it is columbite containing niobium as the major constituent element.

The physical properties of this mineral were observed to be as follows:—Cleavage: *rather distinct in one direction*; Fracture: *uneven, brittle*; Hardness: 6; Specific Gravity: 5·57; Lustre: *submetallic*; Streak: *black*. These agree fairly well with the properties of the columbite-tantalite series of isomorphous minerals. Since the lump of mineral under study

had only one or two partially-developed crystal faces, it has not been possible to observe as to which crystal system it belongs. For the time being, it has to be presumed that the crystal system is orthorhombic as is the case with all the members of the columbite-tantalite group.

Chemical analysis of the mineral has shown that tantalum, iron and manganese are the other important elements present in the mineral. Columbite and tantalite, as is well known, are the niobate and tantalate of iron and manganese respectively with the general formula $(Fe, Mn) (Nb, Ta)_2O_6$ and they pass by insensible gradations from normal columbite, the nearly pure niobate at one end of the series, to normal tantalite the almost pure tantalate at the other.[1] Their specific gravities also vary from 5·3 to 7·3 depending upon the percentage of niobium and tantalum in them. The specific gravity and chemical composition easily fix the place of the mineral under study, at the columbite end of the series. Quantitative chemical analysis is in progress.

The mineral has also been found to be radioactive. The detection and determination of its radio-activity was made by a sensitive α-ray electroscope[2] of the general pattern originally devised by C. T. R. Wilson[3] in his investigation of the natural ionisation of gases, but modified to suit measurement of radio-activity of some of the feebly active mineral sands of Travancore, for which it was specially designed. A comparison of the activity of the mineral with that of a sample of known uranium content, under identical conditions, has given the percentage of uranium equivalent in the mineral as 0·25. The result is being checked by chemical methods.

The occurrence of columbite in Travancore is of some significance in that it is a new addition to the list of radio-active minerals found in the State. The occurrence in Travancore of a mineral belonging to the columbite-tantalite series has not been previously recorded.

The author takes this opportunity to express his grateful thanks to Mr. T. R. M. Lawrie, till recently Director of Mineral Survey and Research, University of Travancore, for his kind guidance and encouragement in the work. His thanks are also due to Mr. A. O. Mathai, Physics Department, University College, for permission to use the α-ray electroscope and for his kind co-operation. The author wishes to record his great indebtedness to Dr. P. V. Nair, Professor of Applied Chemistry, University of Travancore, for valu-

able suggestions and advice throughout the work.

Div. of Min. Survey & Res.,   C. V. PAULOSE.
Central Research Institute,
Trivandrum,
June 16, 1950.

1. Dana, *Text Book of Mineralogy*, 1949, pp. 695–97, 2. Mathai, A. O., *Dissertation for M.Sc., University of Travancore*, 1943. 3. Wilson, C. T. R., *Proc. Roy. Soc.*, 1901, **68**, 152.

OCCURRENCE OF ANDALUSITE NEAR MALLEGOWDANAHALLI (13°-22′; 77°-23′) IN THE DODDABALLAPUR TALUK, BANGALORE DISTRICT

IN the course of the survey of the corundum-bearing rocks in the Bangalore District during the field season of 1949-50, an interesting outcrop of sericite quartzite containing a coarse brown-coloured mineral—later determined to be andalusite—was located at a place about 100 yards south of the corundum workings to the east of Mallegowdanahalli village in Doddaballapur taluk. In the present note, we have given the mineralogical characters of this mineral, while the chemical analysis remains to be done. Details relating to the mode of occurrence and origin of the mineral in this area are being worked out and a separate paper is proposed to be published elsewhere.

The mineral is orthorhombic and occurs in coarse-bladed and prismatic forms, some of the faces showing parallel striations. Colour is brown or reddish brown and the lustre is vitreous. The hardness is over 7 (quartz is scratched) and the specific gravity is 3·14. Prismatic cleavage is very pronounced and traces of basal cleavage are also seen. Broken fragments of the mineral show uneven fracture.

Under the microscope, the mineral shows uniform straight extinction and the colour is pale yellowish green to rose red. The following scheme of pleochroism and optical orientation is noticed:—

X = Pale rose red; deeper shade of red in thick sections.

Y and Z = Light greenish yellow.

Optical orientation 'c' = X.

The mineral is optically negative.

The above characters indicate that the mineral is andalusite. Mr. B. Rama Rao[1] has stated that some of the fine grained micaceous schists in the gneissic complex of Mysore contain andalusite, kyanite and sillimanite, but no specific

zones where andalusite is found have been recorded so far, in any of the publications of the Department. A reference to the occurrence of a brown mineral answering the characters of andalusite, in an area to the south of the present locality, is found in the field notebook of late Mr. P. Sampat Iyengar. This mineral (Z_2/596) has, however, been described by him as idocrase.

Mysore Geol. Dept.,   T. P. KRISHNACHAR.
Tumkur,   C. SURYANARAYANA RAO.
July 8, 1950.

1. *Mys. Geol. Dept. Bull.*, No. 17, p. 51.

A NEW SPECIES OF AZOTOBACTER ISOLATED FROM THE ACID PEATS (*KARI* SOILS) OF TRAVANCORE-COCHIN

AZOTOBACTER is well known for its sensitiveness to reaction. Its limiting reaction has now been fairly generally accepted as pH 5·8 to 6·0. Starkey[1] has reported the isolation of an acid-tolerant Azotobacter from the paddy soils of East Bengal. This, perhaps, is the only instance reported so far of the occurrence and isolation of such an organism. This author, however, has doubted "whether or not the acid-tolerant Azotobacter is widely distributed in soils or will develop in soils over a wide range of reaction still remains to be ascertained". Special media had to be used by him for the isolation of this Azotobacter, the growth of which became apparent only after several weeks of culturing.

In the present work, the author has isolated a similar acid-tolerant organism from Travancore acid (*Kari*) soils having a range of reaction from pH 2·5 to 4·5. It could be isolated on media commonly used for the isolation of Azotobacter. It has a size of 3·5-7 μ as against 0·5 to 1·2 × 1·7-2·7 μ for *az. indicum*, Starkey and 5-6 to 2-3 μ for the other species. One characteristic feature which distinguishes it from the acid-tolerant *Az. indicum* Starkey is its good growth on media supplied with $CaCO_3$. It grows equally well on media free from calcium carbonate. It develops well in nitrogen-free liquid and solid media from the acid limit pH 2·5 to pH 8·5 utilising mannite, sucrose, glucose and lactose. The organism fixed on an average 12 mgs. of nitrogen per gram of mannite. The organism is peritrichious, highly motile and diplococcoid.

The unusual tolerance of the new organism to extreme conditions of soil acidity and its easy isolation differentiate it from any of the previously known species of Azotobacter and even from the acid-tolerant *Az. indicum*. Further details will be published elsewhere.

Div. of Applied Chemistry,   N. SUBRAMONEY.
Central Research Institute,
Trivandrum,
August, 1950.

1. Starkey, *Trans. Inst. Soc. Soil Science*, 3rd commn., A, 1939.

EFFECT OF NICOTINE, QUINOLINE, 3-3′- DIPYRIDYL AND β-PICOLINE ON THE BIOSYNTHESIS OF NICOTINIC ACID IN ANIMALS

NICOTONIC acid can be easily prepared in the laboratory by the oxidation of nicotine, quinoline 3-3′-dipyridyl and β-picoline. The present investigation has been carried out to see whether the animals can utilise these compounds for the biosynthesis of nicotinic acid in their body. The effect of these compounds has been studied by estimating the changes in the urinary excretion of this growth factor after incorporating them with the basal diet.

The technique of the experiment was the same as reported in the previous investigation on riboflavin—the only difference being that nicotinic acid supplement of the previous diet was substituted by 10 μg of riboflavin. The nicotinic acid was estimated by the method of Swaminathan[1] using both the acid hydrolysis, and alkali hydrolysis with urea and the values obtained include nicotinamide, nicotinuric acid, and trigonelline along with nicotinamide methochloride and all the values are expressed as total nicotinic acid. Amyl alcohol was used to extract the colour produced by cyanogen bromide.

The table shows that except β-picoline, the other three compounds did not aid the biosynthesis of nicotinic acid showing that the rats cannot synthesise nicotinic acid from quinoline,

nicotine and 3-3'-dipyridyl. Since quinolinic acid—the oxidation product of quinoline—can easily help the biosynthesis of nicotinic acid when fed to rats as observed by Ellinger et al.[2] it is quite evident from the present results that the rats also cannot convert quinoline to quinolinic acid.

Table showing the effect of feeding nicotine, quinoline, 3-3'-dipyridyl and β-picoline on the urinary excreion of nicotinic acid. (The values indicate the average excretions in μg per rat per day.)

Diet and supplement		Urinary output of nicotinic acid in μg
Basal diet	..	36·3
„ +5 mg. of nicotine	..	34·8
„ +5 mg. of quinoline	..	35·3
„ +5 mg. of 3-3'-dipyridyl		32·2
„ +5 mg. of β-picoline	..	89·3

The increased elimination (2½ times the basal value) due to β-picoline suggests that rats can oxidise those pyridine derivatives which are substituted by the methyl group at the side chain-oxidation taking place at the side chain only. Ellinger et al.[2] have shown that not only methyl but all alkyl substituted pyridine derivatives are utilised by rats for the production of nicotinamide methochloride. The conversion of β-picoline to nicotinic acid can be ranked with the oxidative detoxication mechanism by which the benzene or toluene when fed to rats was found to be excreted in the urine as benzoic acid.

Biochem. & Nutri. Labs.,   H. N. DE.
Dacca University,   P. DATTA, JR.
Dacca, Pakistan,
April 6, 1950.

1. Swaminathan, M., *Ind Jour. Med. Res.*, 1942, **30**, 537. 2. Ellinger, P., Frænkel, G., and Abdul Kader, M. M., *Biochem. Jour.*, 1947, **41**, 559.

KINETICS OF ACETONE AND IODINE REACTION

HALOGENS have been widely used as agents to study prototropy in ketonic and allied substances in their aqueous solutions.[1]

Iodination of acetone was carried out by us to study prototropy of acetone in dark in its aqueous solution catalysed separately by different organic and inorganic acids and their salts. The reaction is of zero order with respect to iodine in absence of the catalyst. It is of first order with respect to both acetone and the acid which is the catalyst used. The reaction was of zero order with respect to iodine in presence of salts but in absence of the acid catalyst.

In presence of the acid catalyst, the ketonic form is converted to the enolic form which in turn is iodinated. K follows the following order:—

$HCl > H_2SO_4 > H_2C_2O_4 > CH_3COOH$. But change in K takes place on addition of salts in the following order:—

HCl	$NH_4 > K > Na > HCl$
H_2SO_4	$H_2SO_4 > NH_4 > Na > K$
$H_2C_2O_4$	$H_2C_2O_4 > NH_4 > K > Na$
CH_3COOH	$NH_4 > CH_3COOH > K > Na$

In acetic acid specially, the buffered solutions of its salts exert an influence on unbuffered acetic acid as regards K with its definite dissociation constant and hence the probable change in value of E. The addition of sodium and potassium acetates decreases the acid catalysed reaction.

Anomalies were noted for K with ammonium salts in the above cases. This is because NH_4 ion is both an acceptor and donor of electrons. P. W. Robertson[2] observed that the rate of iodine addition, in cases having salts containing electron attracting factor, decreases faster as the electron attracting power increases.

Further work in this line is in progress.

Chemical Laboratories,   A K. BHATTACHARYA.
University of Saugar,   S. M. WAKHALE.
Saugar, M. P.,
April 26, 1950.

1. Bell, R. B., and Tautram, A. D. S., *J. C. S.*, 1948, 370-4. 2. *J. C. S.*, 1945, 891-93.

SENSITIVITY OF PATCHOULI TO MANGANESE DEFICIENCY IN SOILS

IN the course of a study on the influence of minor elements on the growth of our crops, it was observed that patchouli (*Pogastemon patchouli*) exhibits characteristic deficiency symptoms which appear to be related to manganese deficiency. Spinach[1] and tobacco[2] plants, among others, have been recognised as being sensitive to deficiency of this and other minor elements. Spinach and patchouli grown in the soil under investigation developed chlorotic leaves indicative of manganese deficiency. In the early stages, there are yellow spots in in the intervenal spaces towards the tip of the

Soil	Pн (KCl extract)	Total		Exchangeable		Reducible Mn	Total available Mn	N %	P$_2$O$_5$ %
		Mn	Fe	Mn	Fe				
			Parts per million						
Deficient ..	8·5	400	3920	48	52	12	60	0·1₁8	1·92
Normal ..	8·0	375	7000	60	60	82	122	0·090	2·10

leaf and at the leaf edges, which as the growth proceeds widen out on either side of the veins and the mid-rib. At maturity, the whole leaf attains a yellow colour with only the mid-rib and veins remaining green.

In patchouli, as with spinach, the leaves are much thinner and the average leaf area smaller than that of the healthy leaves, the foliage also being sparce. In a nearby area where the adverse soil conditions do not prevail, both the types of plants grow in a normal manner producing healthy leaves.

The soils in the two areas were analysed for their content of manganese and other elements and the result sare as shown in the table above.

Of the nutrients analysed, only the available manganese is found to be low in the deficient soil compared to the normal soil.

The normal and chlorotic leaves of the two plants gave the following analysis:

Leaves	Mn In dry material p.p.m.	Fe In dry material %	P$_2$O$_5$ %	N %
Spinach (Healthy)	10·0	46·6	1·84	..
„ (Chlorotic)	7·5	24·2	1·08	..
Patchouli (Healthy)	12·5	42·5	0·87	2·25
„ (Chlorotic)	4·0	28·5	0·84	2·10

Marked differences are found in the manganese content of the leaves, the chlorotic leaves having a lower content of manganese than the healthy leaves. Differences in the iron content are also noted. The chlorotic symptoms are found to be cured in the young leaf by the application of manganese sulphate at 5-10 lbs. per acre in the form of solution.

Chemical Laboratories, S. R. LAKSHMIKANTA.
Agric. Res. Institute,   S. V. GOVINDARAJAN.
Bangalore,
April 17, 1950.

1. Davies. *Agric. Progress*, 1939, **16**, 45. 2. McMurtey, J, R., *U. S, D. A. Tech. Bull.*, 1938, **612**, 30,

POSITION OF DOUBLE BONDS IN THE ALIPHATIC SIDE CHAIN OF THE MONOPHENOL FROM COMMERCIAL CASHEW NUT SHELL LIQUID

THE monophenol obtained by vacuum distillation of either commercial raw cashew nut shell liquid or of solvent extracted liquid has been shown definitely to be a heterogeneous mixture[1] composed of molecules containing, in the straight 15 carbon aliphatic side chain in meta-position to the phenolic OH, one, two and possibly more double bonds, such that a statistical average of two double bonds per side chain is observed experimentally.

The single double bond in the monoolefinic component has been assigned by Sletzinger and Dawson[2] the 8, 9 position in the side chain counting from the nucleus, on the basis of isolation of heptaldehyde from the products obtained from treatment of the monophenol with Prevost reagent and oxidation of the resulting glycol with periodic acid. This conclusion was later confirmed by synthetic methods by the same authors.[3]

Results obtained independently in this laboratory by a different method of oxidation furnish evidence not only to confirm the above structure for the monoolefinic component, but also to permit one to fix the relative positions of the double bonds in the diolefinic component.

Among the products of oxidation, with potassium permanganate in acetone solution, of the monophenol from vacuum distilled commercial liquid, acetic, valeric, heptylic, oxalic, azelaic and suberic acids have been isolated and identified. The methyl ether of the same monophenol, under identical conditions of oxidation, yielded acetic, valeric, heptylic, *m*-anisic, oxalic, and pimelic acids (pimelic acid alone needing further confirmation).

The presence, among oxidation products of the phenol, of heptylic and azelaic acids confirms the following structure for the monoolefinic component, proposed by Dawson and co-workers, the dotted lines indicating the cleavage points during oxidation,

$$-CH_2-(CH_2)_6-CH=CH-(CH_2)_5-CH_3$$
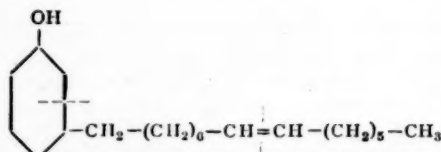
The breaking of the nucleus under the given oxidation conditions, seems to be made possible by the unsaturated side chain and the OH occupying the 1, 3 positions in the nucleus. The corresponding methyl ether of the mono-olefinic component would be expected to break at the 1, 2 and 8, 9 positions of the side chain, giving *m*-anisic, pimelic and heptylic acids, as has experimentally been verified.

The isolation, in addition to the above acids, of valeric and oxalic acids in the oxidation products both of the phenol and its ether, suggests for the diolefinic component a conjugated double bond structure.

$$-CH_2-(CH_2)_6-CH=CH-CH=$$
$$CH-(CH_2)_3-CH_3$$
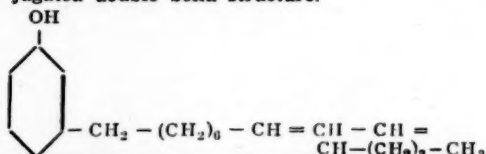
The fact that oxalic acid is found in both cases, and that its yield is qualitatively less in the case of the ether, seems to indicate that the oxalic acid from the ether must come almost exclusively from the conjugated double bond. Possibility of rerrangement prior to oxidation cannot absolutely be ruled out, to elucidate which further chemical and spectroscopic study is in progress; but the above evidence appears to be, for the moment, conclusive.

It is to be noted that the presence of acetic acid in the oxidation products of the phenol and its ether, may be due to oxidation of solvent acetone under alkaline condition progressively brought about during permanganate oxidation, and possibly also to the breaking of a particular and as yet unidentifiable double bond. As for the presence of suberic acid from the phenol alone, a definite explanation must await further investigation which is being actually conducted. Full details of the material here presented will be published elsewhere.

Dept. of Chemistry,   V. J. PAUL.
Loyola College,   L. M. YEDDANAPALLI.
Madras,
June 1, 1950.

1. *cf.* Previous letter by V. J Paul, *et al. 2. J. Am. Chem. Soc.*, 1946, **68**, 345. 3, *J. Org. Chem.* 1949, **14**, 670 & 849.

DIRECT COMPUTATION OF ORIENTATION POLARISATION FROM DILUTE SOLUTION DATA

IN a previous note[1] it was shown that the observed linearity of dielectric constant with concentration in dilute solutions of nonpolar solvents can be quantitatively interpreted on the basis of the Clausius-Mosotti expression for polarisation. Assuming the linear dependence of specific volume with concentration, it was found that

$$a = \frac{\epsilon_{12}-\epsilon_1}{\omega_2} = \frac{3}{V_1-p_1} \left\{ (p_2-p_1) + \left(\frac{p_2-p_1-\beta}{V_1-p_1}\right) p_1 \right\} \quad (1)$$

whence

$$p_2 = \frac{3aV_1}{(\epsilon_1+2)^2} + (V_1+\beta)\frac{\epsilon_1-1}{\epsilon_1+2}. \quad (2)$$

Similarly on the basis of the Lorenz-Lorentz expression for electronic polarisation

$$p_E = \frac{n^2-1}{n^2+2} \cdot \frac{1}{d},$$

$$\gamma = \frac{n_{12}^2-n_1^2}{\omega_2} = \frac{3}{V_1 - {}_Ep_1} \times$$
$$\times \left\{ ({}_Ep_2 - {}_Ev_1) + \left(\frac{{}_Ep_2 - {}_Ep_1 - \beta}{V_1 - {}_Ep_1}\right){}_Ep_1 \right\} \quad (8)$$

whence

$${}_Ep_2 = \frac{3\gamma V_1}{(n_1^2+2)^2} + (V_1+\beta)\frac{n_1^2-1}{n_1^2+2} \quad (4)$$

Combining (2) and (4)

$${}_0p_2 = (p_2 - {}_Ep_1) = 3V_1 \left\{ \frac{a}{(\epsilon_1+2)^2} - \frac{\gamma}{(n_1^2+2)^2} \right\}$$
$$+ (V_1+\beta) \left\{ \frac{3(\epsilon_1-n_1^2)}{(\epsilon_1+2)(n_1^2+2)} \right\} \quad (5)$$

Thus if a, β and γ are experimentally determined, the orientation polarisation ${}_0p_2$ and hence the dipole moment μ can be directly computed from equation (5) knowing the constants for the solvent ϵ_1, n_1 and V_1.

If $(\epsilon_1-n_1^2)$ is small and hence ignored, equation (5) reduces to either

$${}_tp_2 = \frac{3V_1(a-\gamma)}{(\epsilon_1+2)^2} \quad (6)$$

or

$${}_0p_2 = \frac{3V_1(a-\gamma)}{(n_1^2+2)^2} \quad (7)$$

A noteworthy feature of equations (6) and (7) is that it is not at all necessary to know β, the concentration coefficient of density of solution, in order to calculate ${}_0p_2$. The data of Few and Smith[2] on aniline and its derivatives has been chosen to illustrate the relative merits of equations (5), (6) and (7). Values for a and β have been taken directly from Few and Smith's paper whereas γ has been evaluated as

the slope of the $n_{12}^{2} - \omega_2$ plots which, in all cases, are straight lines.

	γ	$_0p_2$ by equation No.		
		(5)	(6)	(7)
Aniline	..	0·238	47·64	47·15	47·78
(Benzene)	..			(47·65)	
Aniline	..	0·498	64·00	61·77	67·65
(Dioxane)	..			(64·19)	
Methyl–	..	0·202	57·26	56·82	57·19
(Benzene)	..			(57·39)	
Methyl–	..	0·454	70·29	67·45	73·87
(Dioxane)	..			(70·49)	
Dimethyl–	..	0·169	52·80	52·26	52·95
(Benzene)	..			(52·89)	
Dimethyl–	..	0·397	56·60	53·10	58·15
(Dioxane)	..			(56·58)	

The values computed by equation (5) agree very well with those of Few and Smith tabulated above in parenthesis ($_0p_2 = p_2 - [R_D]$). For benzene solutions where ($\epsilon_1 - n_1^2$) is very small equations (6) and (7) give values of $_0p_2$ differing by not more than 1 per cent. from the values calculated by equation (5). However, for dioxane solutions, where ($\epsilon_1 - n_1^2$) is appreciable, $_0p_2$ by equations (6) and (7) deviates by more than 5 per cent. from the true value given by (5).

In this connection it is to be pointed out that the recent 'simplified' relationship put forth by Guggenheim[3] for computing dipole moments from solution data corresponds to the simplified forms (6) and (7) derived in this note and hence is applicable only for solvents like benzene where ($\epsilon_1 - n_1^2$) is negligigle. Had Guggenheim chosen for his calculations data on dioxane solutions, the failure of his relationship would have been brought out.

Bangalore,   B. R. YATHIRAJA IYENGAR.
June 12, 1950.

1. Yathiraja Iyengar, *Curr. Sci*, 1950, **150**. 2. Few and Smith, *J. Chem. Soc.*, 1949, 753. 3. Guggenheim, *Trans. Farad. Soc.*, 1949, 714.

INVESTIGATIONS ON PYRO-PHOSPHATO COMPLEX OF ZINC IN SOLUTION

PAHL[3] claimed to have isolated a solid pyrophosphato complex of zinc having the formula $3Na_4P_2O_7 \cdot Zn_2P_2O_7 \cdot 24H_2O$, by the spontaneous evaporation of a solution of zinc pyrophosphate

in sodium pyrophosphate at summer heat. Bassett[1] and his co-workers could not confirm his result. The author has, however, observed by different physico-chemical methods, such as used in the case of pyrophosphato complex of lead[2] and also by Cryoscopy measurements in saturated sodium sulphate solution that the complex ion $[Zn(P_2O_7)_2]^{-6}$ exists in the solution. The instability constant K of the complex ion $[Zn(P_2O_7)_2]^{-6}$ has been found out to be $3 \cdot 17 \times 10^{-7}$ at $35° \mp 0 \cdot$ C., where $K[Zn(P_2O_7)_2^{-6}]$ $= [Zn^{+2}][P_2O_7^{-4}]^2$ and the square terms indicate concentrations.

The complex ion $[Zn(PO_7)_2]^{-6}$ has probably the following structure with two six membered rings and the co-ordination number of the central zinc ion is four.
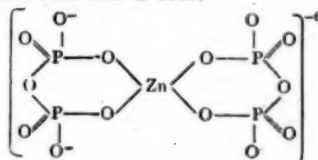
My best thanks are due to Prof. P. B. Sarkar, Calcutta University, for his keen interest and for giving laboratory facilities during the progress of the work.

Inorganic Chemistry Laboratory,
University College of Science
   and Technology,   B. C. HALDAR.
92, Upper Circular Road,
Calcutta-9.
June 14, 1950.

1. Bassett, Bedwell and Hutchinson, *J. Chem. Soc.*, 1936, 1412. 2. Haldar, B. C., *Curr. Sci.* (in previous communication). 3. Pahl, *Ofvers. K. Vet. Akad. Forh.*, 1873, **30**, 29.

THE FRIES MIGRATION OF THE ARYL ESTERS OF ALPHA AND BETA NAPHTHOIC ACIDS

CONSIDERABLE work has been carried out on the Fries migration using esters of monohydric phenols with various acids, though much remains to be done especially with those of aryl acids and longchain unsaturated acids with phenols.

In the present investigation this rearrangement ha sbeen studied with the phenly, *ortho-*, *meta-*, and *para-*cresyl esters of *a*-naphthoic acid at two different temperatures of 100° C. and 160° C. At the high temperatures the *ortho-* and at low temperatures the *para-*hydroxy ketones were obtained, which were characterised by the formation of their 2·4–

Dinitrophenylhydrazones. However, some of the observations are noted below:—

Ester	Hydroxy-ketone	M.P.	M.P. of 2·4-Dinitro-hydrazone
1. Phenyl-α-naphthoate	*p*-Hydroxy-phenyl α-naphthyl ketone	165-66° C.	287° C.
2. *o*-Cresyl-α-naphthoate	*m*-Methyl-*p*-hydroxy α-naphthyl ketone	165° C.	260° C.
3. *m*-Cresyl-α-naphthoate	1-Methyl-3-hydroxy 4-α-naphthyl ketone	semi-solid	289-90° C.
4. *p*-Cresyl-α-naphthoate	1-Methy-4-hydroxy 3-α-naphthyl ketone	145° C.	221° C.

Corresponding work with β-naphthoic acid is being carried out. Fuller details shall be published elsewhere.

Dept. of Chemistry,   G. S. SAHARIA.
University of Delhi,
June 19, 1950.

ESSENTIAL OIL FROM THE FLOWERS OF CAMPHIRE OR HENNA PLANT

THE essential oil from the flowers of *Lawsonia inermis* or *Lansonia albav* does not seem to have been studied so far. Deshpande[1] reported that the oil contains a ketone $C_{12}H_{20}O_2$, b.p. 100-02/5 mm.

On steam distillation of the Henna flowers, an essential oil, dark brown in colour, is obtained in 0·02 per cent. yield. It has a very fragrant smell when diluted and congeals on keeping. The fractionation of the oil gave a pale yellow-coloured liquid b.p. 135-40/$_{12}$ m.m. as the main component which darkens on keeping and had the following physical constants.

$n_D^{25} = 1.5010$

sp. gravity = 0·9462

(I)
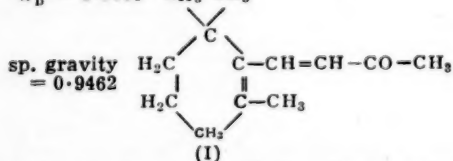
The oil gives a crystalline semicarbazone $C_{14}H_{23}ON_3$, m.p. 149° C., and a dintrophenyl-hydrazone $C_{19}H_{25}O_4N_4$ m.p. 150° C. corresponding to the formula of a monoketone $C_{13}H_{20}O$ for the oil. By comparison of the properties tabulated below, we infer that the chief component of the essential oil from Camphire or Henna flowers is β-ionone (I) and further α-ionone is not known to occur in nature. The mixed melting points of the semicarbazones and the dinitrophenylhydrazones obtained respectively from the essential oil from Henna and from a genuine sample of β-ionone showed no depression.

TABLE

Property	Ketone from Henna	β-Ionone	α-Ionone
B.P.	135-40/12 mm.	134-35/14 mm.	123-24/11 mm.
sp. gravity	d_{20} 0·9462	d_{17} 0·9460	d_{20} 0·9320
Refractive index — n_D^{20}	1·5033	1·5097	1·4980
Semicarbazone, m.p.	149° C.	148-49° C.	(i) 107-08° C.⎫ (ii) 137-38° C.⎭
2, 4-Dinitrophenylhydrazone, m.p.	120° C.	120° C. (not described)	125-28° C.
Oxime	No crystalline oxime obtained	Oxime described to be an oil	m.p 89-90° C
Unsaturation	+	+	+

Besides β-ionone, the essential oil also contains a compound containing nitrogen and a resin. Further work is in progress.

Chemistry Laboratory,   M. B. ANTIA.
Holkar College, Indore,   R. KAUSHAL.
June 29, 1950.

Proc. Soc. Biol. Chemists, India, 1938, 3 (iii), 88.

ELECTRO-DEPOSITION OF METALS AND ALLOYS FROM CYANIDE-FREE BATHS
Part I.—Silver from Iodide Solutions

THE electro-plating industry uses the cyanide bath for the plating of silver (copper, cadmium, gold, etc.), because of its superiority over other types of baths. But the bath suffers from certain serious disadvantages, namely, its poisonous nature and its tendency to decompose, thereby necessitating careful control. It is, therefore, desirable to have a satisfactory substitute for the cyanide bath.

In the present work, silver has been electro-deposited on copper from a silver iodide bath (obtained by dissolving silver salt in alkali iodide) which is much simpler in composition than those attempted before.[1,2,3,4] As in the cyanide bath, simple immersion deposition is considerably minimised as a result of complex formation, which reduces the effective silver ion

concentration. The latter has been determined by the E.M.F. method. A detailed study has been made of the effect of variation in (a) concentration of silver, (b) concentration of iodide and (c) current density, on the electro-deposition, with baths containing potassium as well as sodium iodides. The deposits are white, dense and readily polishable and the bath is quite comparable to the cyanide bath in respect of quality and adherence of deposit, cathode efficiency and c.d. range. The cathode and anode efficiencies are practically 100 per cent. over a wide range of c.d. and composition. The c.d. range, conductivity and throwing power are found to be higher with the potassium than with the sodium iodide bath. The optimum conditions are: 20 to 40 g/L silver, 400 to 600 g/L potassium or sodium iodide, 0·2 to 1·6 amp/dm² (stirring) c.d., 0·1 to 0·3 volts and 26° C.

The effects of temperature, agitation, ageing, pH and addition agents on plating, have been studied. Increase of temperature and agitation improves the anode corrosion and raises the maximum permissible c.d. Ageing has little effect. Contrary to the observation of other workers,[3,4] pH as such, is not of much significance but the specific reagent added to vary the pH, is found to have a marked effect on the electro-deposition. Ammonium sulphamate and sodium thiosulphate act as brighteners. The conductivity and cathode polarisation have been measured, the throwing power, as calculated from c.d.—cathode potential curves, is as good as that of the cyanide bath.

The silver iodide bath possesses some important advantages over the cyanide bath in respect of simplicity of composition, ease of control, stability and non-poisonous nature. Furthermore, the high conductivity, low polarisation and low bath voltage lead to lower power consumption. In view of these considerations, this bath appears to be a very promising substitute for the cyanide bath.

Our thanks are due to Prof. B. Sanjiva Rao, Head of the General Chemistry Section, for giving all facilities and taking interest in the work.

Electro-Chemistry Lab.,   T. L. RAMA CHAR.
Gen. Chem. Section,   R. SADAGOPACHARI.
Indian Inst. of Science,
Bangalore-3,
August 9, 1950.

1. Schlotter, *Chem. Abs.*, 1933, **27**, 5251. 2. Fleetwood and Yntema. *Ind. and Eng. Chem.*, 1935, **27**, 340. 3. Alpern and Toporek. *Trans. Electrochem. Soc.*, 1938, **74**, 321. 4. Levin, *Electroplating*, 1948, **1**, 315.

THE INFLUENCE OF DIETARY PROTEIN ON THE CYSTINE AND METHIONINE CONTENTS OF LIVER PROTEIN

SEVERAL investigators have studied the variations in the sulfur-containing components of the liver in experimental animals under various dietary conditions.[1-5] Some of the results are rather divergent. Recently it has been reported[6] that a considerable alteration occurs in the methionine-cystine ratio of the liver in rats fed for 15 months a low protein rice diet due mainly to a marked reduction in the methionine content.

The authors have determined the cystine and methionine contents of the whole liver proteins from rats fed for different periods a typical poor rice diet as well as synthetic diets of widely varying protein content. The results are presented in this communication.

Comparable groups of young albino rats, 4 weeks old, with an average body weight of 35-40 gm. and containing equal numbers of both the sexes were used for the experiments. The diets were given *ad lib.*

The basal rice diet was composed of: Raw polished rice 79·0 per cent., Tur dhal 5·0 per cent., Non-leafy vegetables (potatoes and brinjals) 8·3 per cent., Leafy vegetables (chiefly amaranthus) 2·2 per cent., Ghee 5·0 per cent., and common salt 0·5 per cent.

The chemical analysis of the dry diet was as follows: Protein (N × 6·25) 5·89 per cent.; Fat 6 per cent.; Ash 1·8 per cent.; Total sulfur 0·1 per cent.; Phosphorus 0·2 per cent.; Methionine 0·164 per cent.; Cystine 0·095 per cent.

The rice, dhal, vegetables and salt were cooked in 4 volumes of water. The ghee was added later to the cooked diet and thoroughly mixed. As far as possible, the same cooking conditions were maintained throughout the experimental period. The average water content of the cooked diet was 74 per cent.

The synthetic diets contained different proportions of protein as shown in Table I together with the following: Cocoanut oil 10 per cent., cane sugar 5 per cent., salt mixture 4 per cent., and corn starch to make up the rest.

Each of the animals receiving the vitamin supplemented rice diet as well as the synthetic diets was given daily 1 drop of a solution of Adexolin diluted 10 times with refined groundnut oil and 0·2 g. of Brewers' Yeast (Squibb) with 40μg. of thiamine and 70 μg. of riboflavin added extra.

The livers from the experimental animals were excised under amytal anæsthesia after bleeding through the abdominal aorta. The

Letters to the Editor

TABLE I

Cystine and Methionine contents of Liver Protein in Rats

Diet	No. of animals	Period of feeding (Weeks)	Average daily intake*		Liver protein nitrogen	Liver protein sulfur	Methionine	Cystine
			Food (g.)	Protein (g.)	(mgm./100 gm. body weight)		(Per cent. of liver protein containing 16% N)	
Rice diet	8	14	8·1	0·47	105±1·31	10·8 ±0·61	4·2±0·20	1·5±0·28
	10	24	8·5	0·49	106±1·81	11·3 ±0·81	4·3±0·17	1·2±0·33
	8	36	7·8	0·46	104±2·20	10·9 ±0·10	4·1±0·17	1·5±0·17
Rice diet with vitamin supplements	8	14	8·9	0·58	107±2·11	11·1 ±0·72	4·1±0·17	1·3±0·09
	10	24	8·6	0·56	108±1·83	10·8 ±0·86	4·0±0·17	1·1±0·04
	8	36	8·8	0·54	106±1·61	11·0 ±0·15	4·0±0·36	1·6±0·37
Synthetic diets 20% casein	6	12	8·0	1·68	121±1·99	12·56±0·30	4·3±0·10	1·2±0·00
10% casein	6	12	8·8	0·96	113±1·68	10·01±0·12	3·9±0·37	1·2±0·07
5% casein	6	12	8·8	0·49	105±2·10	9·32±0·19	4·2±0·00	1·2±0·26

* Determined during the last two weeks of the experimental period.

livers thus obtained (as free from blood as possible) were dried to constant weight at 95°C. and then powdered. The dry powder was used for the chemical analyses.

Total protein nitrogen and sulfur were determined on aliquots of the dry powder after extraction with 5 per cent. trichloracetic acid. Methionine and Cystine were estimated on the dry fat-free residue of the powder after extraction with ether-alcohol (1 : 3) mixture.

The micro-Kjeldahl procedure was followed for the estimation of nitrogen and the differential oxidation procedure of Evans[7] for those of total sulphur, cystine and methionine.

The results are given in Table I above.

No significant differences were observed in the cystine and methionine contents of the liver proteins in the various groups, in spite of wide variations in the protein content of the diets and in the period of feeding on the low protein rice diet.

Our grateful thanks are due to Dr. V. Subrahmanyan and Prof. V. R. Naidu for their interest and kind encouragement.

M. R. SAHASRABUDHE.

M. V. LAKSHMINARAYAN RAO.

Div. Biochem. & Nutri.,
Central Food Tech. Res. Inst.,
Mysore,
June 12, 1950.

1. Lee, W. C., and Lewis, H. B., *J Biol. Chem.*, 1934, **107**, 649. 2. Miller, L. L., and Whipple, G. H., *J. Expt. Med.*, 1942, **76**, 421 3. Shaffer, C. B, and Critchfield, F. H., *Proc. Soc. Expt. Biol.*, N. Y., 1945, **59**, 210. 4. Leaf, G., and Neuberger, A., *Biochem. J.*, 1947, **41**, 280. 5. Dent, C. E., *Ibid.*, 1947, **41**, 314. 6. Nutrition Research Laboratories (I.R.F.A.), Coonoor, India, *Report for* 1948-49. 7. Evans, R. J., *Arch. Biochem.*, 1945, **7**, 439.

INFLUENCE OF METHIONINE AND CYSTINE ON THE METABOLISM OF RATS

THE influence of zinc and of choline on the metabolism of nitrogen, phosphorus and sulphur in rats has been reported in earlier communications.[1,2] It is of interest, therefore, to investigate the influence of methionine, another well-known lipotropic agent and of cystine, the other sulphur amino acid of importance in nutrition. Such an experiment would be of value because cystine has been reported to bring about increased deposition of fat in liver when given alone, while on the other hand enhancing the lipotropic activity of choline when given in combination with it.[3]

The experiment was conducted in the manner described in the earlier experiments but consisted of five groups of four rats each. The arrangements of the groups and the results of the experiment are summarised in Table I from which it will be seen that the supplements brought about changes in metabolism quite differently from what was observed in the case of zinc, though this element in common with choline possesses lipotropic activity. It is also observed that while choline, acting alone or in combination with cystine, showed marked reduction in the fat content of liver, methionine at the level of 100 mg. per cent. did not lower the same. Cystine when given alone showed markedly increased deposition of fat in liver.

TABLE I

Effect of supplements of choline, methionine and cystine on metabolism of rats fed on a high fat, low protein diet

		Control, High fat low protein diet alone	Supplements			
			100 mg. choline chloride per cent.	100 mg. methionine per cent.	100 mg. cystine per cent.	100 mg. cystine +100 mg. choline chloride per cent.
Increase in body weight (15 days) gm.		19·0	17·0	28·0	15·0	17·0
Food intake in grams (15 days)		123·3	122·2	135·7	107·4	101·2
Metabolism of nitrogen : mg.						
Urinary	..	634·9	409·4	416·9	252·4	190·9
Fæcal	..	178·6	185·3	189·7	160·9	132·3
Retention	..	811·7	1031·4	1177·6	1015·3	1053·8
Metabolism of phosphorus : mg.						
Urinary	..	228·4	157·5	209·4	155·2	133·1
Fæcal	..	122·9	119·9	129·5	109·4	110·2
Retention	..	137·3	161·7	148·9	120·1	119·2
Metabolism of sulphur : mg.						
Urinary	..	18·749	17·409	22·672	16·929	18·550
Fæcal	..	34·521	33·659	37·478	31·864	33·996
Retention	..	−5·250	−0·600	21·225	21·030	13·230
Analysis of liver :						
Final body weight gm.	..	77·5	77·0	93·5	74·0	77·0
Fresh weight of liver gm.	..	7·29	6·22	9·47	7·31	4·92
Liver weight as % of body weight		9·41	8·07	10·13	9·88	6·39
Fat content of liver gm.	..	2·115	1·199	2·665	3·039	0·614
Fat percentage in liver	..	29·05	18·75	28·23	42·20	11·28

In spite of these differences in their influence on liver fat, it was clearly noticed that they all affected metabolism almost identically. They brought about decreased elimination of urinary nitrogen, phosphorus and sulphur while also increasing their retention, thus indicating that their importance in nutrition is connected with some phase of general metabolism other than that indicated by their lipotropic activity.

Further work is in progress and details will be published elsewhere.

My thanks are due to Major-General Sir S. S. Sokhey and Dr. K. Ganapathi for their interest in the work.

Haffkine Institute,   V. SADASIVAN.
Bombay,
June 26, 1950.

1. Sadasivan, V , *Curr. Sci.*, 1950, **19**, 129. 2. —, *Ibid.*, 1950, **19**, 211. 3. Beeston, A. W., and Channon, H. J., 1936, **30**, 280.

ON A NEW CILIATE *NYCTOTHERUS KALII* NOV. SP. FOUND IN THE TADPOLES OF THE INDIAN FROG, *RANA CURTIPES* JERDON

THE new species (*Nyctotherus kalii*) described here was found in the intestine of the tadpoles of the forest-dwelling frog, *Rana curtipes*. The distinguishing features are, (1) the form and position of the macronucleus and (2) the prominent thin margin or the flange around the body. It has been named after the river Kali, from where the tadpoles were obtained.

Several tadpoles (with hind limbs developed) were opened and the material thus obtained was studied both fresh and in the form of smears. The usual method of fixing and staining (*e.g.*, Bouin's fixative and Delafield's hematoxylin) was followed. All the drawings have been made with the aid of camera lucida.

Nyctotherus Kalii Nov. Sp.

The ciliate when seen from above appears somewhat oval. The two plates of the body namely, the dorsal and the ventral differ both in form and size. The ventral plate is large and tapers anteriorly to a narrow blunt point. Posteriorly it is broader. The dorsal plate, however, being comparatively small, leaves a prominent wide margin over the ventral. This margin or the flange (about 30-40 microns in width) is so thin that the ciliary lines over here are clearly visible. Near the anterior pole the ventral plate is slightly concave for a short distance. The dorsal surface as usual is deeply convex. The short peristome leads into the

cytopharynx which is quite simple in structure
and curves round inside the middle of the body.
Numerous small and large vacuoles are seen
distributed irregularly in the cytoplasm. A
large contractile vacuole was always pre-
sent near the anal opening. The cilia
lining the peristome and the cytopharynx
are specially long and thick. Those on the
body are short and fine. The macronucleus
somewhat oval in form is placed immediately
over the cytopharynx. Its narrowly pointed
anterior pole is almost facing the anterior pole
of the body and roughly makes an angle of 41°
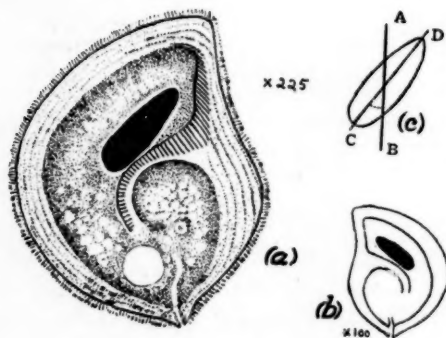to the main axis of the body. The micronucleus
could not be detected.

FIG. 1 (*a*) *Nyctotherus kalii* nov. sp. from the tadpoles
of the frog *Rana curtipes* Jerdon. (*b*) The same under
low power of microscope. (*c*) Shows the angle made by
the macronucleus to the principal axis of the body.
The line AB represents the principal axis of the body
and CD is the line joining the anterior and posterior
poles of the macronucleus.

Measurements in microns:—Body (length $\times$
breadth) range 250-300 $\times$ 200-240; macro-
nucleus (length $\times$ breadth) range 85-110 $\times$
25-35; nuclear angle 41°; width of flange 30-40.

There is similarity between the flange de-
scribed in this new species of *Nyctotherus* and
that described by Wichterman in *Nyctotherus
cheni* from the Chinese frog, *Rana spinosa*. But
there is difference in the form of both the
cytopharynx and nucleus. Table I shows how
N. kalii nov. sp. differs from the one described
by Wichterman.

A subpharyngeal tube described in *N. cheni*
Wicht., is absent in *N. kalii* nov. sp. Also the
macronucleus in *N. cheni* is triangular with a
very broad anterior pole, while in *N. kalii* it
is oval and has a narrow anterior end. Even

TABLE I

	N. cheni Wicht.	*N. kalii* nov. sp.
Body size ..	Average 179 × 121 mcr.	Average 280 × 223 mcr.
Macronucleus ..	Triangular with interior end broadly rounded. 49 × 26 mer.	Oval with anterior end narrowly rounded. 101 × 30 mcr.
Nuclearie ang ..		41°
Subpharyngeal tube	Present	Absent.
Width of flange	15 mcr.	30–40 mcr.

in the width of the body-flange and general
body contour, the two species differ very
much. For these reasons, *N. kalii* has been
considered as a new species.

Department of Zoology,   J. C. UTTANGI.
Karnatak College, Dharwar,
July 6, 1950.

1. Bhatia, B. L., "Protozoa (Ciliophora)," *Fauna of
British India*, 1936.   2. Carini, A., "Contribuico ao
estudo dos nictoteros dos batraquios of Brazil," *Arcuios
de Biologia Ano*, 1939, **23**, 220.   3. Uttangi, J. C., "Note
on *Nyctotherus cochlearis* nov. sp. from *Rana curtipes* Jrd.,"
Curr. Sci., Nov.' 48, **17**, 325–26.   4. Wichterman, R.,
"A New Protozoan Parasite *N. cheni* (ciliate) from
Chinese Frogs," *Parasitology*, 1934, **26**, 2.

EFFECT OF STORAGE ON THE VITAMIN-C CONTENT OF CANNED FOODS

THE following work was undertaken to assess
the stability of vitamin-C at room temperature
in products processed locally.

A number of tins of the canned product pro-
cessed in the morning from the same batch of
the foodstuff, were brought to the laboratory.
One of the tins was assayed for vitamin-C on
the same day by the Robinson and Stotz me-
thod with formaldehyde procedure.[1] The pro-
duct was blended in a waring blendor for about
2-3 minutes with 0·5 per cent. oxalic acid solu-
tion. The intensity of the unreduced dye,
extracted in xylene, was noted in a Klett Sum-
merson Photo Electric Colorimeter with a green
filter.

The following table gives the data for vita-
min-C content during a storage period of 4
months in canned guavas, pine apples and pota-
toes.

It has been reported that pine apple and pine
apple juice retain most of their vitamin-C on
storage at 10° and 18·3°. (Moschette *et al* 1947).[2]
Our studies, however, show loss of about 83

per cent. during the four months' storage-period when the average room temperature was 28-30° C.

Changes in vitamin-C content on storage in canned foodstuffs at 28-30° C.
mg. per 100 g.

	Whole can *	Solids	Syrup †	% Solids in the can	% Loss
Pine apple					
Freshly canned	25·81	15·90	15·12	58·5	..
After storage for—					
1 month	21·27	13·08	13·00	58·3	17·7
,, ,, 2 months	13·19	6·96	9·6)	58·8	49·0
,, ,, 3 ,,	7·32	4·11	5·15	59·8	71·7
,, ,, 4 ,,	4·42	0·80	4·20	51·8	82·9
Guavas					
Freshly canned	265·10	98·77	124·0)	41·0	..
After storage for—					
1 month	211·80	138·00	124·00	61·3	20·0
,, ,, 2 months	205·80	116·40	135·00	58·5	22·3
,, ,, 4 ,,	127·20	65·57	76·25	53·6	52·0
			† Brine		
Potatoes					
Freshly canned ..	19·59	13·26	10·00	60·5	..
After storage for—					
1 month	14·19	9·78	10·00	68·8	27·6
,, ,, 2 months	13·82	9·06	8·60	63·7	29·5
,, ,, 3 ,,	8·90	5·76	5·10	61·2	54·6
,, ,, 4 ,,	6·51	4·79	5·25	65·4	66·8

* Total content of vitamin C in the can apportioned to solids only.

† mg. per 100 ml.

In the case of guavas, a retention of about 48 per cent. of the original vitamin-C content was noted for over 4 months. Thus it appears that vitamin-C is more stable in canned guavas as compared to canned potatoes and pine apple samples studied.

Biochem. Dept.,   G. A. DHOPESHWARKAR.
The Inst. of Science,   N. G. MAGAR.
Bombay 1,
July 12, 1950.

1. Robinson, W. B., and Stotz, E., *J. Biol. Chem.*, 1945, **160**, 217. 2. Moschette, D. S., Hinman, W. F., and Halliday, E. G., *Ind. Eng. Chem.*, 1947, **39**, 994.

THE EARLIEST REFERENCE TO LAC IN CHINESE LITERATURE

IN 1919, Laufer[1] stated: "The *Wu Lu* written by Chang Po in the beginning of the fourth century contains the following text on the subject of ant-lac." His translation is reproduced further below but it is neither complete nor literal. Strange enough, Laufer does not refer to the previous translation, by Prof. A. Pfizmaier[2] of Vienna, which appeared in 1874. Although this is complete, it does not reproduce the sense quite happily, so that a third translation seemed desirable. A copy of the Chinese text was sent to me through the kindness of Prof. Tan Yun-Shan of Shantiniketan, which was translated here by Prof. Mu Pai-Hui, formerly also of Shantiniketan. It is a pleasure to express my thanks again to both these Chinese scholars. I have been responsible for the form in which the translation is being presented, by having given preference to some synonyms over others; but I have added notes to explain my choice.

Laufer translates as follows: "In the district of Kü-Fun in Kiu-Chen, Tonking, there are ants living on coarse creepers. The people, on examining the interior of the earth, can tell the presence of ants from the soil freshly broken up; and they drive tree-branches into these spots, on which the ants crawl up and produce a lac that hardens into a solid mass." This is Laufer's entire translation, which may be critically compared with the following, by Prof. Mu Pai-Hui: "(1) In the northern portion of Chiu-Chen (now Indo-China) there is the district named, I-Fung, where a gum (Chiao) is used for dyeing raw-silk (Hsü) red. (2) By observing the soil the people can tell where the ants are. (3) And because of ants) they dig holes there and plant branches of trees into them. (4) The ants crawl upon the branches and produce the lac (Ch'i). (5) It hardens into a mass resembling a cocoon (or rather) the egg-case of a mantis. (6) It has a pure (bright) red colour. (7) It is this gum which dyes raw-silk red."

In sentence No. 1, the word *chiao* is translated as *gum*. The original word has also been used in a generic sense; chiao also means glue, being the sense preferred by Pfizmaier, who renders it, in German, as *leim*. The same sentence contains the term "raw-silk", for the Chinese word, Hsü. It is character No. 4474 in the *Chinese Dictionary* of Giles, with the meaning, "refuse silk or cotton". Since cotton does not take to lac-dye, only some kind of silk can be meant here. Pfizmaier renders the same word as "flockseide" or "floss-silk", which is another synonym for refuse silk. I, however, feel that the more general term, raw-silk, best expresses the sense of the original text. In sentence No. 4, *Ch'i* is a well-known word translated as *lac*. It usually means lacquer in Chinese, but here lac is the best substitute for

it. Pfizmaier gives it as *pech* or *pitch*, which hardly suits the context. In sentence No. 5, the Chinese text contains a phrase which has been very well expressed. Incorporated in that phrase is the word *p'iao*, character No. 9130 in Giles. This author gives another synonymous phrase again with *p'iao*, which he translates as "an egg-cocoon, like that of the mantis". This is exactly what Chang Po also meant. Gum-lac, as a specific term, is rendered in Chinese as *ant-lac*, which Laufer correctly expresses.

Gum-lac is sometimes seen in small round chunks, illustrated as early as 1760, by Ledermüller.[3] Slightly larger pieces have been shown in 1789, by Roxburgh and in 1947, by myself[1] when I have also reproduced Roxburgh's pictures. Small in size and, attached to fine twigs such lac encrustations do resemble egg-cases of mantis; hence a comparison between them both seems most appropriate. The contents of sentence No. 4 strikes us as naive. It can nevertheless be confirmed, as by the following quotation from the *Cyclopedia* of Chambers[5] published in 1876, where we read that, "Father Tachard, who was on the spot (in India), tells us that a kind of little ants, fixing themselves on the branches of trees, leave behind them a reddish moisture which, lying exposed to the air and sun, hardens in five-six days' time and becomes *lacca*". Such reports can be confirmed by questioning country folk even to-day.

Cipla Laboratories,   S. MAHDIHASSAN.
Bombay 8,
August 5, 1950.

1. Laufer, B., *Sino-Iranica*, 1919, p. 475. 2. Pfizmaier, A., *Sitzb. Akad.*, Wien., 1874, **78**, 383. 3. Ledermüller, M. G., *Mikroskopische Gemüts-und Augenergötzung*, 1760. 4. Mahdihassan, S., *J. Bombay Nat. Hist. Soc.*, 1947, **47**, 329. 5. Chambers, E., *Cyclopedia*, 1786. Quoted in Parry's, E. J., *Shellac*, 1935, p. 3.

PHOSPHATE FIXATION IN ALLUVIAL SOILS

THREE views have recently but quite independently developed on P_2O_5 fixation in soils. Perkins and Coworkers,[1] and Richards and Collaborators[2] hold that particle size influences phosphate fixation. Larger the particle size, the lesser is the fixation as the total surface for activity is proportionately reduced. According to Laatsch[3] positive secondary valencies of the clay mineral lattice are saturated with humus leaving very little scope for P_2O_5 fixation. On the other hand, Dunn[4] believes that humus which acts only as a cementing material when suitably removed, increases phosphate fixation.

During the course of an investigation on the effect of continuous cropping on the nutrient status of the alluvial soils of Kanpur, it occurred to us to test the above three views on phosphate fixation, as shown by the soils of our permanent manurial plots running over nearly 66 years. The soils as reported by the authors[5] are micaceous. The more important results are incorporated in Table I.

The data presented in the table show that clay in general fixed the most P_2O_5 followed by silt and sand. These fractions of the unmanured plot have fixed more than the manured; this is evident in the first foot of the soil which is cultivable.

Removal of the humus by H_2O_2 increased P_2O_5-fixing capacity. The original soil fixed 0·1420 mgm. P_2O_5 as compared to 0·1471 mg. P_2O_5 for the H_2O_2 treated soil. When the mean increase after peroxide treatment is compared, it will be observed that the mean for the manured increased by 0·0059 mgm. per cent., as compared to 0·0043 mgm. per cent., for the unmanured soil. This increase is definitely due to

Phosphate-fixing capacity of alluvial soils at different depths in both manured and unmanured plots

TABLE I

	Manured annually with dung supplying 100 lb. N. per acre				Unmanured			
	0–6″ mgm. %	6″–1′ mgm. %	1′–2′ mgm. %	Mean mgm. %	0–6″ mgm. %	6″–1′ mgm. %	1′–2′ mgm. %	Mean mgm %
Soil	0·0642	0·1120	0·2265	0·1342	0·0921	0·1495	0·2082	0·1499
H_2O_2 treated soil	0·0721	0·1181	0·2302	0·1401	0·0984	0·1539	0·2105	0·1542
Depression in P_2O_5 fixing capacity due to organic matter	−0·0079	−0·0061	−0·0037	−0·0059	−0·0063	−0·0044	−0·0023	−0·0043
Sand fraction	0·0016	0·0012	0·0003	0·0010	0·0025	0·0016	0·0006	0·0016
Silt fraction	0·0620	0·1850	0·2160	0·1540	0·0930	0·2060	0·2270	0·1750
Clay fraction	0·4640	0·3710	0·6490	0·4610	0·5870	0·5560	0·6180	0·5870

removal of humus for both manured and un-manured soils.

This lower P_2O_5 fixing capacity of the manured soil may be attributed to the dual role of humus; the excess of added humus in excess of that naturally present, besides partly saturating the partial secondary valencies acts also as a cementing agent. Such cementing effect is possibly not marked because of the small amounts of humus in the unmanured soil. The difference of $0 \cdot 0016$ mg. or 37 per cent. mg. P_2O_5 of the total P_2O_5 fixing capacity of the manured soil therefore, may be ascribed to the decementing after peroxide treatment, and $\cdot 0043$ mg. fixation in both the soils due to the saturation of the partially-saturated secondary valencies of the mineral lattice. This effect of organic matter is thus due to both the partial saturation of the secondary valencies of the mineral lattice by the organic colloids and the external coating of humus on the soil particles.

The above results thus clearly demonstrate that all the three factors which are reported to effect P_2O_5 fixation operate almost simultaneously in our soils. Whether they operate in other types of soils is being examined on laterites and *regurs*.

Chemistry Section,   A. N. PATHAK.
Govt. Agric. College,   S. K. MUKERJI.
Kanpur,   J. G. SHRIKHANDE.
July 26, 1950.

1. *Soil Sci.*, 1942, **53**, 37. 2. —, *Ibid.*, 1949, **67**, 3. Kolloid, *Ztschr.*, 1943, **102**, 60. 4. *Soil Sci.*, 1943, **58**, 297. 5. *Curr. Sci.*, 1949, **18**, 373.

THREE STYLED *ORYZA*

GRAMINEÆ is characterised by two styles with plumose stigmas except in a few primitive Bambuseæ which have three styles. *Oryza* also has generally the two styles; sometimes a third additional "nonstigmatic process" may be present (Arber, 1934). Hector (1936) while describing the gynæcium of *Oryza sativa* states that a third style may be present. In a vast collection of about 2,200 types of *Oryza* obtained from different parts of the world and maintained at the Paddy Breeding Station at Coimbatore, a West African species *Oryza grandiglumis* Prodoehl., showed the three styled condition in many of the spikelets. Normal two styles were also found in the same plant. The third style with the stigmatic branch was normal in all respects (Fig. 1).

The serial transverse sections of the ovaries from the three styled and the normal two styled spikelets were examined to compare the vascular strands. The normal *Oryza sativa*

FIG. 1

showed two vascular strands on the ovary wall (Fig. 2). This is in conformity with the observations of Saunders (1928) and Arber (*loc. cit.*).

FIG. 2

But the three styled *Oryza grandiglumis* has three vascular strands (Fig. 3) and this justi-

FIG. 3

fies the normal third style in the species. In the case of the two styled ovaries of *O. grandi-*

glumis, the vascular condition agrees with the normal *Oryza sativa*. The isolation of the three styled condition is being carried out. Saunders (1937) reports a more or less similar case in *Spartina stricta* where two or three vascular strands in the ovary wall end in correspondingly two or three stigmatic branches. On the other hand, the same worker reports *Stipa pinnata* which has the three vascular strands but is lacking in the third stigmatic branch.

Though the ovary of Gramineæ is generally considered to be of three carpels, there is no unanimity of this view; some consider it to be of a single carpel (Bews, 1929). If the vascular strands are taken to represent the midribs of the carpels as viewed by Arber, the present case with the three styles and the three vascular strands adds support to the tricarpellary view. Further work on this aspect is in progress.

We are thankful to Sri. M. B. V. Narasinga Rao, Paddy Specialist, for providing the material.

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May 17, 1950.

1. Arber, A., *The Gramineæ*, Univ. Press, Cambridge, 1934, 152-53. 2. Bews, J. W., *The World's Grasses*, London, 1929, 6. 3. Hector, J. M., *Introduction to the Botany of Field Crops*, Central News Agency, S. Africa, 1936, 288. 4. Saunders, E. R., *New Phytolo*., 1928, 27, 59-60. 5. --, *Floral Morphology—A New Outlook*, Heffer & Sons, Ltd., Cambridge, 1937, 129-30.

CERCOSPORA LEAF-SPOT ON *SCHREBERA SWIETENIOIDES* ROXB.

A CERCOSPORA leaf-spot on *Schrebera swietenioides* Roxb. was first observed at Nagpur in 1948. The disease is indicated by the appearance of minute yellowish specks on the upper side of the leaves which soon turn chocolate in colour and become visible on the underside as well. The young spots are at first roundish, but later become irregularly angular. As they mature, the centre turns dirty brown to greyish-white and becomes slightly depressed. Later on clusters of conidiophores appear in the whitish areas on either side of the leaves as minute black dots. Several adjacent spots often coalesce together, forming large patches of dead areas on the leaf-blades. Later in the season the spots occur on petioles and twigs. The spotted leaves gradually turn pale, dry and fall off.

The hyphæ of the pathogen are chiefly intercelluar, sub-hyaline to brown, septate and frequently branched. The sporodochia are large, stromatic and typical in shape. They are formed either under the epidermis, within the epidermal cells, beneath the cuticle or in the substomatal spaces. The conidiophores emerge through the epidermis or stomatal openings. They may also arise singly from the external mycelium. They are brown, continuous or 1 to 5-septate, usually undulate, frequently nodulose, simple or sparingly branched, occasionally once or twice geniculate and measure 9-54·2 (average 25·44) $\times$ 2·4-6·2 μ (average 3·12).

The conidia are sub-hyaline to pale olive brown in colour, cylindrical to obclavate in shape, sometimes typically branched, usually curved and occasionally constricted at septa. As they grow old, one or more oil-globules appear in each cell. They are 1 to 10-septate, usually 3 or 4-septate and measure 18·3-87·0 (average 46·47) $\times$ 2·8-6·1 μ (average 3·60). They germinate in water in 12 to 18 hours. The germ-tubes usually arise from the terminal cells, but occasionally from one or two intermediate cells. Anastomosis between germ-tubes or germinating conidia occurs occasionally.

Spraying the foliage with a conidial suspension resulted in the characteristic symptoms of the disease in 7 to 10 days. Examination of the infected leaves showed that the organism enters through the stomata.

The pathogen was isolated in pure cultures. The organism when grown on rice-meal agar at 22° C. began to grow actively on the 4th day, forming densely matted dark greenish-grey, circular colonies with a greyish-white fluffy ærial growth in the centre. The colonies measured 8-12 mm. in 12-15 days. The hyphæ measure 0·9-4·7 μ (average 3·42). The submerged hyphæ are darker in colour and more frequently branched than the aerial ones. Conidia are not formed in cultures.

Since the organism does not seem to have been described before, and since its habitat, characters of stromata, conidiophores and conidia on the host and cultural characters are typical, it is considered to be a new species and named *Cercospora schreberæ* n. sp.

My thanks are due to Dr. R. P. Asthana, Mycologist to Government, Madhya Pradesh, for the facilities accorded to study the problem.

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Nagpur,
June 10, 1950.

AN 'IN VITRO' STUDY ON THE ACTION OF ACRIDINE BIGUANIDE DERIVATIVES UPON SOME PATHOGENIC MICRO-ORGANISMS

THE bacteriostatic activity of the acridine drugs was first observed by Browning, *et al.*[1] and this was later followed by the discovery of 'atebrin' as the most important acridine antimalarial compound.[2]

The general effectiveness of the acridine compounds against a wide variety of bacteria is well establishd.[3a, 3b]   These acridine antibacterials, aminoacrine, proflavine, acriflavine, salacrine, etc., are superior in one respect, to penicillin and sulphonamides, as they do not produce resistant strains of organisms.[4,5] But their general usefulness is much limited as the drugs are excreted quickly and do not persist in blood stream for sufficiently long time. Nevertheless, the long persistence of atebrin in blood encourages the hope of finding some suitable acridine antibacterials. Biguanide sulphanilamide derivatives and paludrine acetate have been found to have bacteriostatic effect against some gram-positive organisms.[6]

The present investigation was undertaken with the object of determining the effectiveness of some acridine biguanides as antibacterial agents. These compounds were originally synthesised as possible antimalarials.[7] It is well known that quite a number of 'enteric infections' are complicated with malaria and any antimalarial drug having, in addition, some antibacterial properties against enteric group of organism, will certainly prove very fruitful during the epidemic of enteric infection.

With this object in view, these compounds were tested against *Bact. coli* and *Bact. typhosum* besides the usual pathogenic gram-positive organisms. The antibacterial spectrum of these compounds is given below (Table I).

A perusal of the table shows that paludrine has slight antibacterial activity against all the orgaisms while 5-amino acridine is bacteriostatic in fairly high dilutions against both gram-positive and gram-negative organisms. The combination of the two groups (acridyl biguanides) in general seems to have enhanced the activity against the gram-positive organisms and some of the compounds 3, 4 and 5 are found to be powerful bacteriostatic agents against *Bact. typhosum* and *Bact. coli.*

Our thanks are due to Prof. P. C. Guha for kindly offering the compounds and to Dr.

TABLE I

Compound	Minimum bacteriostatic concentration (48 hrs. incubation at 37° and pH 7·2)			
	Organism			
	Staphylo	Strepto-hemolyticus	*B. coli*	*B. typhosum*
1 5-Amino acridine	1 : 25,000	1 : 10,000	1 : 10,000	1 : 10,000
2 N'-(α-naphthyl)-N⁵-(5-acridyl) biguanide hydrochloride	1 : 20,000	1 : 20,000	1 : 2,500	1 : 2,500
3 N'-(5-acridyl)-N⁵-(P. cl. phenyl) biguanide hydrochloride	>1 : 50,000	>1 : 50,000	1 : 10,000	1 : 10,000
4 N'-(2 : 4 dichlorophenyl)-N⁵-(5-acridyl) biguanide hydrochloride	1 : 30,000	1 : 30,000	1 : 12,500	1 : 12 500
5 N'-(5-acridyl)-N⁵-(p. bromophenyl) biguanide hydrochloride	1 · 50,000	1 : 50,000	1 : 12,500	1 : 12,500
6 N'-(2-chloro 7 methoxy acridyl)-N⁵-(p-chlorophenyl) biguanide hydrochloride	1 : 25,000	<1 : 10,000	<1 : 10,000	<1 : 10,000
7 N'-(p-bromophenyl)-N⁵-(2 chloro-7-Methoxy acridyl) biguanide hydrochloride	1 : 50,000	1 : 50 000	1 : 5,000	1 : 2,500
8 N'-(p-Iodophenyl)-N⁵-(5 acridyl) biguanide hydrochloride	1 : 50,000	1 : 5,000	1 : 10,000	1 : 10,000
9 Paludrine hydrochloride	1 : 10,000	1 : 5,000	1 : 5,000	1 : 1,000

N. N. De and Dr. K. P. Menon for the keen interest evinced in the work.

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Ind. Inst. of Science,　　　　P. R. Gupta.
Bangalore 3,　　　　　　　　R. Rama Rao.
August 2, 1950.

1. Browning, *et al.*, *Jour. Path. Bact.*, 1913, **18**, 144. 2. Mauss and Mietzsch, *Klin. Wach.*, 1933, **12**, 1276. 3 (*a*) Benda, *et al.*, *Berichte.*, 1912, **45**, 1787. (*b*) Berry, *Q. J. of Pharm. and Pharmaco.*, 1941, **14**, 363. 4. Gilmour, *et al.*, *J. of Path. Bact.*, 1913, **18**, 144. 5. Garrod, *et al.*, *Lancet.*, 1940, 798, 845. 6. Natarajan, S., *et al.*, *Curr. Sci.*, 1947, **15**, 156. 7. Gupta and Guha (To be published).

DEVELOPMENT OF EMBRYO SAC AND ENDOSPERM IN *STYLIDIUM TENELLUM* SWARTZ.

In *Stylidium tenellum* Swartz., a member of the Stylidiaceæ, the hypodermal archesporium is differentiated in the young nucellar primordium and it functions directly as the megaspore mother cell (Fig. 1). Tetrad formation takes place normally, the chalazal megaspore functions and the development of the embryo sac (Figs. 3, 4), follows the Polygonum type.[1] Occasionally, a T-shaped tetrad is met with or the division in the upper dyad cell is oblique (Fig. 2).[2,5,6]

The mature embryo sac is long (Fig. 4) and is surrounded by an endothelium whose cells at the lower end become filled up with dense contents. The synergids are long and hooked and the egg is pear-shaped. The secondary nucleus is large and the antipodal cells persist (Figs. 6-8) during the early stages of endosperm development.[2,3,5,6] Double fertilisation takes place normally (Fig. 5) and immediately after fertilisation the synergids shrivel and degenerate.

Endosperm development is cellular. The primary endosperm nucleus divides much earlier than the fertilised egg. Its division is followed by the laying down of a transverse wall (Fig. 6) resulting in a primary micropylar and primary chalazal chamber. Next, vertical walls are laid down in both the primary chambers, thus resulting in a 4-celled endosperm. Transverse walls are now laid down first in the lower tier of cells (Fig. 7) and then in the upper tier; thus an 8-celled endosperm is formed (Fig. 8). *Stylidium graminifolium*[5] and *Levenhookia dubia*[6] are slightly different in that transverse walls are first laid down in the upper tier and then in the lower. At the 8-celled stage of the endosperm, the two cells of the upper tier develop into the micropylar haustorium and those of the lower form the chalazal haustorium. The two middle tiers of cells by further divisions form the main body of the endosperm. The development of the endosperm thus follows the Scutellaria type[4] and
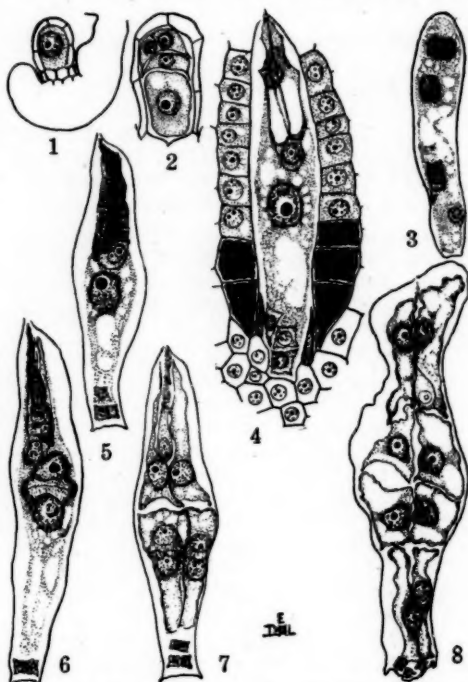

Fig. 1. Megaspore mother cell ×485. Fig. 2. Megaspore tetrad with oblique wall in the upper dyad cell ×970. Fig. 3. Third nuclear division from megaspore leading to formation of 8-nucleate stage ×970. Fig. 4. Mature embryo sac showing the elongated synergids and endothelium ×970. Fig. 5 A stage in double fertilisation ×679. Figs. 6-8. Stages in the development of the endosperm and the differentiation of the micropylar and chalazal haustoria. Figs. 6, 7 ×679. each; Fig. 8 ×485.

a similar sequence of divisions has been reported in *Stylidium adnatum*,[2] *St. graminifolium*,[5] and *Levenhookia dubia*.[6]

It gives me great pleasure to thank Prof. P. Maheshwari for sending me the preparations, on which the present observations are made; I also thank Prof. L. N. Rao for kind encouragement and the National Institute of Sciences of India for the award of a Research Fellowship.

Dept. of Botany,　　　　　　K. Subramanyam.
Central College, Bangalore 1,
August 29, 1950.

1. Maheshwari, P., *Bot. Rev.*, 1948, **14**, 1-56. 2. Rosén, W., *Bot. Notiser.*, 1935, 273-78. 3. —, *Ibid.*, 1949, **2**, 137-47. 4. Schnarf, K., *Vergleichende Embryologie der Angiospermen*, 1931, Berlin. 5. Subramanyam, K., *Lloydia*, 1950 *a* (in press). 6. —, *Proc. Nat. Inst. Sci., India*, 1950 *b* (in press).

REVIEWS

Vacuum Equipment and Techniques. By A. Guthrie and R. K. Wakerling. (McGraw Hill Book Co., Inc., New York), 1949. Pp. 264. Price $ 2·50.

The much-discussed and much-condemned atomic weapon of war, conferred at least one benefit on experimental science and that is the development of high vacuum systems of colossal dimensions, far exceeding the size of the largest molecular stills. The routine production of high vacuum required on an unprecedented scale in the electromagnetic separation process was entrusted to a group, nay a team, of eminent scientists and engineers of the University of California Radiation Laboratory, under a contract with the Manhattan Project. The magnitude and nature of the problems involved compelled a good deal of pioneering work on both equipment and testing techniques.

The excellent monograph under review, is based on a record of the observations made by the personnel of the U.C.R.L. in the course of this development and as such is a fitting memorial to the accomplishments of science, Industry, Government, Labour, Army and Navy working harmoniously as a team. E. O. Lawrence, the Director of Radiation Laboratory, gives away the secret of this remarkable achievement in his Foreword to the book, where he says: "*The entire laboratory organization was characterised by a minimum of formal procedure consistent with the nature of the work . . . . The form of laboratory organization was such as to allow a maximum of individual expression with regard to the various problems encountered, which undoubtedly contributed considerably to a maximum of co-operation.*" (italics ours)

The first chapter of the book deals with the fundamental theoretical considerations of vacuum practice, where it is assumed that the reader is already versed in the kinetic theory of gases. Special equations of vacuum practice are developed and discussed in extenso.

The subsequent chapters are concerned more with the practical aspects of the various elements of a high vacuum system, including the design and operation of mechanical, jet and diffusion pumps, various types of cold traps, high vacuum valves and finally the construction of vacuum chambers and process tanks which could be relied on to hold the vacuum. Various devices for producing motion in vacuum chambers, new instruments for vacuum measurements, detection of leaks with the mass-spectrometer and a host of other topics related to the industrial application of high vacuum are all very well discussed. There is an extended appendix which includes a summary of formulæ useful in vacuum design, certain constants, conversion factors, data on pump oils, vacuum greases, effectiveness of various drying agents, etc.

References are made liberally to the available published literature.   M. V. C. SASTRI.

Fire in Buildings. By Eric L. Bird and Stanley J. Docking. (Messrs. Macmillan & Co., London), 1949. Pp. 295. Price 15 sh. net.

This book is an excellent survey of the work carried out during recent years in the field of fire protection and fire-resistance of structures. It covers nearly 300 pages divided into 15 chapters and is illustrated with numerous diagrams, charts, drawings, and photographs.

Tracing the history of the early fire-combating and fire-preventive measures, and recalling the poignant tales and disastrous results of some of the world's worst fires, the authors analyse the complex factors influencing the behaviour of fire in buildings and explain the basic aims of fire protection in the first five chapters, and proceed to discuss the principles and practice of fire-protection methods as have emerged from the fire-research laboratories in England and America, and the practical results achieved so far.

The concept of "fire load" which expresses the total calorific value of the combustible contents of a structure and its occupancy per unit area—and thus a measure of the relative potential severity of a fire in a structure—is utilised to evolve a rational system for assessing fire-risks and classifying buildings according to their fire-resisting properties. The modern method of "fire grading" and the recommendations of the Fire Grading Committee based on this fundamental concept are discussed in the text in great detail.

Of particular interest are the results of tests on the behaviour of materials and structures under varying conditions of fire, and the time-temperature graphs showing the relationship between the rise in temperature and duration of fire.

The remaining chapters are devoted to the planning and design of structures for fire-resistance. The numerous illustrations of the

application of the theory of compartmenting to varied types of structures and the different fire-preventive devices described in these chapters should be of special interest to all practising architects and planning engineers.

N. S. GUPCHUP.

Practical Physics. By Sir Cyril Ashford. (Cambridge University Press), 1950. Pp. 173 + xii. Price 10 *sh.* 6*d.*

It is now a matter of common recognition that on account of the large increase in the number of students proceeding to study physics at the intermediate and Pass stages and inadequate equipment of our laboratories, teachers are unable to give their best in the matter of practical work. Individual attention is no longer possible. These causes have led to much deterioration in the quality of physics teaching. Much of the work in the laboratory is done in a routine manner, without any regard to accuracy of observation, correlation with theory and proper utilization of available data.

This sorry state of affairs needs immediate revision at the hands of those interested in the advancement of science in this country. One of the books which is sure to help the zealous reformer is the one under review. Sir Cyril Ashford has brought to bear on this work his considerable experience as teacher and examiner.

In the Introduction, several practical points in the reduction of observations are clearly and briefly stated. Due emphasis has been laid on graphical methods, which are illustrated with suitable examples.

The fifty exercises described in the book are generally based on questions set in recent year in the Higher School Certificate papers. The orthodox teacher may rightly claim that the experiments are not those usually prescribed in our colleges. But as review experiments and for frequent practical tests, the exercises are well adapted. Each exercise is accompanied by a note on the underlying theory.

To those teachers in South India who are continually for reducing standards, one may mention that the experiments outlined in the book are essentially intended for pre-university examinations. The experiments require apparatus usually existing in any laboratory. The reviewer agrees wholeheartedly with the author in the view that a student should learn to rely on his own powers rather than on elaborate equipment.

Students and teachers of physics will find much in the book which will be instructive and useful.

S. R. R.

Intermediate Organic Chemistry. By P. B. Sarkar. (H. Chaterjee & Co., Ltd., Calcutta), 1950. Pp. 178. Price Rs. 2-8-0.

The book is an abridged edition of the relevant chapters of *Organic Chemistry,* by Sarkar and Rakshit, intended for B.Sc. students of the Indian Universities. The book mostly deals with the Chemistry of the aliphatic compounds. The preparation, properties, uses and technical applications, if any, of important members of each group of compounds are clearly and concisely described in the first seventeen chapters of the book. Amongst aromatic compounds the Chemistry of benzene, its homologues, naphthalene, and the more important derivatives of benzene are discussed in the last four chapters.

The arrangement of the subject matter is quite good, the presentation is excellent and very readable. There is ample information for the Intermediate students; and others who read the book will find a useful introduction for the further study of Organic Chemistry. On the whole, this is an excellent book for the Intermediate students and there is no doubt that the book will be as popular as the bigger volume on the same subject by the author.

M. SHADAKSHARA SWAMY.

Jan Ingenhousz: Plant Physiologist, with a History of the Discovery of Photosynthesis. By Howard S. Reed, Ph.D. (*Chronica Botanica,* 11, No. 5/6). (The Chronica Botanica Co., Waltham, Mass., U.S.A.; Macmillan & Co., Ltd., Calcutta, India), 1949. Pp. 393. Price $ 3·00.

This book is a fully annotated and well-illustrated reprint of Ingenhousz's classical work on plant physiology. This distinguished eighteenth-century physician first attained fame by immunizing patients against small-pox by vaccination. His versatile mind later set itself to the study of Physics and certain aspects of plant physiology. Experimenting in the latter field of science, he achieved some important results. He showed that plants exhaled "dephlogisticated air" (oxygen) during photosynthesis, that this activity was unconnected with growth, and that it was very vigorous in bright sunlight, that it decreased as light declined and that it ceased altogether in darkness. Ingenhousz (1730-99) was the first to observe respiration in plants although he was not aware of its significance. Repeating Priestley's experiments he found that green parts of plants "vitiated" the air around them in darkness, while non-green parts like flowers, fruits and seeds also behaved similarly both in darkness and light. Ingenhousz was not even aware of

the nature of this vitiating gas. It was only in 1804 that De Sassure carried out the first experiments in respiration and it became evident that carbon assimilation and respiration were two different activities of the green plant, but going on simultaneously during the day. The effect of atmospheric electricity on plants also engaged his attention but yielded no important result. His study of soil chemistry led him to think that the soil also drew oxygen from the air and gave out carbon dioxide. He little realised that this oxidation was due to micro-organisms.

Essentially of historical interest, the book deals mainly with Ingenhousz's experiments, his technique, the apparatus he used, his explanation of technical terms, his inferences and his dedication of his work to Sir John Pringle, from whom he received inspiration and encouragement. A special chapter outlines the "chemical studies that led to the discovery of photosynthesis" and reviews the works of scientists like Hales, Cavendish, Priestley, Senebier and others, who were all interested in photosynthesis. The commentator who is none other than Prof. H. S. Reed, well known for his *History of the Plant Sciences*, has made the book very interesting and instructive. He has not only shown the value of Ingenhousz's work judged by the contemporary knowledge of plant physiology, but has also shown its directive influence on subsequent research in this branch of knowledge. Each experiment or set of experiments on a particular subject is described in Ingenhousz's own words. The commentator then adds very useful notes annotating the experiments and tracing further developments in the subject till modern times. A valuable list of references at the end of each chapter, a short biographical sketch, a couple of letters from Franklin to Ingenhousz and several hitherto unpublished illustrations of topical interest, all contribute to the importance of the book. Clear types, faultless printing and a neat get-up greatly add to its charm.

A. R. RAO.

Botanical Nomenclature and Taxonomy (*Chronica Botanica*, 1950, 12, No. 1/2). Edited by Prof. J. Lanjouw, Ph.D. (Publishers: Waltham, Mass.: The Chronica Botanica Co., Calcutta: Macmillan & Co., Ltd.) Price $ 2·50.

The appearance of this work is most timely in connection with the sessions on nomenclature at the 7th International Botanical Congress now being held in Stockholm. For this, plant taxonomists and systematists owe a debt of gratitude to the editor of this work, Prof. J. Lanjouw. The book gives a report of a symposium organised by the International Union of Biological Sciences, with the support of the UNESCO at Utrecht in June 1948. As Prof. Lanjouw states in his preface to the Report, this symposium was a means of bringing together a few of the leading botanists and taxonomists for a preliminary meeting "to pick up the threads of international contacts, which had been cut so roughly in 1939," and to consolidate view-points to be placed before the 7th International Botanical Congress. This Report embodies detailed minutes of the discussions at the symposium, so carefully recorded by Mrs. M. L. Sprague, and includes also valuable supplements. One of these deals with the amendments to the International Rules of Botanical Nomenclature made at the 6th International Congress, and in another, "On the Need for an International Society of Plant Taxonomists", Prof. Lanjouw makes a strong plea for the organisation of such a body. It is also noteworthy that the report contains some references to the early history of Botanical Nomenclature incorporated in the body of the proceedings of the symposium.

Altogether, the Report should be a welcome and valuable addition in all the botanical laboratories, and should be especially useful to botanical workers in the field of systematics and nomenclature. It is, however, felt that the price of the book is a little too high.

ESBEEKAY.

Introduction to the Bacteria. By C. E. Clifton. First Edition. (McGraw Hill Book Co., Inc., New York), 1950. Pp. xii + 528. 179 diagrams and photographs. Price $ 5·00.

The publication of text-books on general bacteriology is by no means uncommon and the majority of such books show a pronounced bias towards medical bacteriology. It is seldom realised that by far the largest number of micro-organisms occurring in nature are nonpathogenic to plants, animals or humans and many of them are intimately associated with the every-day life of man. Yet, information regarding this very large group of organisms, which is of fundamental importance, is not commonly presented.

The book under review is a welcome departure from the usual methods of presentation of the subject and is intended, as the author so aptly puts it in his dedication, for "those students who develop an interest in the bacteria,

as bacteria." The book is divided into 24 chapters, the first 7 dealing with the introduction and general observations on bacteria, protozoa and algæ, true fungi and viruses. Then follow some very interesting chapters on the energy requirements of bacteria, microbial respirations, metabolic grouping of bacteria and growth requirements, multiplication and death of bacteria. After discussing the utility of Bergey's classification, the author deals, in the course of next 7 chapters, with some aspects of applied bacteriology such as those pertaining to soil, water, air, food and industries. The mechanisms of infection and resistance, serological reactions, and characteristics of the family Enterobacericeæ have been described in the next 3 chapters followed by a concluding chapter on microbiology of infectious disease.

The material is presented in a clear and critical manner taking into consideration the latest developments in the various branches of bacteriology. The book is written in a very readable style, is profusely illustrated with beautiful photographs and charts, and contains numerous references and an index. The get-up of the book is excellent and this reviewer commends it highly to everyone interested in bacteriology.

K. K. IYA.

Administration Reports of the Director of National Museums, Colombo, for 1948 and 1949. (Ceylon Government Press, Colombo). Price 55 cents each.

These business-like reports give the impression that the Government of Ceylon do not treat their museums as the Cinderalla of Government departments. The Island has a large national museum at Colombo and three regional museums at Jaffna, Kandy and Ratnapura, and all of them had, during the two years under report, vigorous programmes of research and collection. The total number of visitors to the Colombo Museum, in 1949, was 188,183 and of these about 20 per cent. were school children, indeed a very pleasing and healthy record. There is also to be found a proper balance between research, gallery work, publication, and educational activities. On the research side specially noteworthy is the paleontological and prehistoric work of the Director in Ceylon and in Africa as a member of the University of California African Expedition. Research in Anthropology which was interrupted during the war has been resumed and is making very good progress. Another very

pleasing feature, little known in India, is the number of gifts which the National Museum has been getting from the members of the public. The *Spolia Zeylanica*, the periodical publication of the Museums Department, has also maintained its very high standards. Mr. P. E. P. Deraniyagala, the versatile Director of the National Museums, deserves to be congratulated on the excellence of the record of work for these two years.

A. A.

Modern Text-book of Intermediate Physics—Vol. II. By Amarendra Nath Banerjee, M Sc. (Published by Das Gupta & Co., Ltd., 54/3, College Street, Calcutta).

The book has been written primarily with the intention of providing a suitable modern treatment (as the title indicates) of the subject matter of Physics for the Intermediate classes. With this object in view, the author has included topics such as dispersion in optics and alternating currents in electricity (which he has referred to in the preface) which are not ordinarily taught in the Intermediate classes. The Intermediate stage should certainly be made more substantial and from this point of view, the attempt is very welcome.

While the author's desire that the students should be enabled to draw from the 'pages of nature' is commendable, it is possible to disagree with the method adopted in the book to secure that end. For example, the mention of the dualistic nature of light in the opening pages tends to obscure the young mind rather than help him to proceed step by step. Facts must be carefully and judiciously presented and theories must be made to appear as natural developments arising from the presented wealth of facts. Moreover in an effort towards developing a scientific tendency, accuracy of statement is very important. The errors of commission such as on Page 49, where radius of curvature (which is a distance) has been referred to as a straight line and omission such as on Page 74, where no mention is made of the fact that sini/sin r depends on colour ought certainly to be avoided. Several mistakes in the spelling of words as also misprints are to be corrected. However, considerable amount of new material has been added and the illustrations given are helpful. The desire of the author to create a love for the subject among the beginners could perhaps be better realized by suitable acknowledgements, references and suggestions for further study.

D. S. SUBBARAMAIYA,

SCIENCE NOTES AND NEWS

Estimation of Argemone Oil in a mixture of Argemone and Mustard Oils

Shri. K. P. Bhargava, Manager and Chief Chemist, Juggilal Kamlapat Oil Mills, Cooperganj, Kanpur, writes as follows :—

Dr. S. N. Sircar in an article published in *Current Science*, August 1945, Pp. 196-197, describes a chemical method for the estimation of alkaloids present in argemone oil and its application to a mixture of argemone and mustard oils. In the last paragraph of the article it is stated that the method with practically the same degree of accuracy is applicable to a mixture of argemone and mustard oil, even when the percentage of argemone oil was as low as 5 per cent.

The present writer, however, by adding a known amount of argemone oil, say one c.c. to 20 c.c., of the suspected sample of mustard oil taken in a stoppered flask (I) and taking an equal amount, i.e., 1 c.c. of argemone oil in another stoppered flask as control (II) and by following the technique described by Dr. S. N. Sircar and estimating the picrates in both (I) and (II) and deducting the amount of picrates (II) from the amount of picrates (I) has been able to estimate quantitatively argemone oil in a sample of mustard oil even when the percentage of argemone oil in mustard oil is 0·5 per cent. By taking 40 c.c. of the suspected sample and adding 2 c.c. of argemone oil and taking same quantity, i.e., 2 c.c. of argemone oil as control and using proportionate quantities of reagents, it is even possible to estimate quantitatively with fair degree of accuracy if argemone oil is present in mustard oil upto 0·25 per cent.

Nutrition Workers Meeting in Bangalore

A joint meeting of the Nutrition Advisory Committee of the Indian Council of Medical Research and the Animal Nutrition Committee of Indian Council of Agricultural Research was held at the Indian Dairy Research Institute, Bangalore, on the 29th and 30th June, 1950, under the presidency of Dr. K. C. Sen, Director, Indian Dairy Research Institute, Bangalore.

The members stressed the need for collecting relevant information on the nutritional requirements of human and cattle population in this country and for this purpose appointed a Sub-Committee with Dr. K. C. Sen (*Chairman-Convener*), Dr. V. V. Patwardhan, Director, Nutrition Research Laboratories, Coonoor

(*Secretary*), and 3 other members. It was decided that this Sub-Committee would draft a memorandum to be placed before the Planning Commission in due course detailing the various aspects of this problem and suggesting tentative measures in consultation with the Agricultural and Animal Husbandry Departments of the Centre and various States for the realisation of the targets.

The production of soya bean extract in relation to Agricultural Economy was also discussed, but in view of the fact that adequate documented data on the yields and production of soya bean was not available to the Joint Meeting, it was recommended that the problem of its production in India on a commercial scale be referred to the Agricultural Ministry of the Government of India requesting them to take into account particularly the effect which the cultivation of soya bean will have on relieving or modifying food shortage and on the agricultural economy of the country in general.

Regarding the desirability of solvent extraction of fat from oil-bearing seeds and cakes, the Joint Committee felt the need for a careful scrutiny of the various facts of the problem and appointed for that purpose a Sub-Committee with Prof. B. N. Banerjee of the Indian Institute of Science as convener and six other members, to report on the merits of the case.

Unesco Verdict on Race Discrimination

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has just made public its authoritative pronouncement on the controversial subject of race.

The main points of the experts' conclusions are:

(1) Racial discrimination has no scientific foundation in biological fact.

(2) The range of mental capacities in all races is much the same. There is no proof that the groups of mankind differ in intelligence, temperament or other innate mental characteristics.

(3) Extensive study yields no evidence that race mixture produces biologically bad results. The social results of race mixtures are to be traced to social factors. There is no biological justification for prohibiting inter-marriage between persons of different ethnic groups.

(4) Race is less a biological fact than a social myth. As a myth, it has in recent years taken a heavy toll in human lives and suffer-

ing and still keeps millions of persons from normal development, and civilization from the full use of the co-operation of productive minds.

(5) But, scientifically, no large modern national or religious group is a race ; nor are people who speak a single language, or live in a single geographical area, or share in a single cultural community necessarily a race.

(6) Tests have shown essential similiarity in mental characters among all human racial groups. Given similar degrees of cultural opportunity to realize their potentialities, the average achievement of the members of each ethnic group is about the same.

(7) All human beings possess educability and adaptability, the traits which more than all others have permitted the development of men's mental capacities.

International Union of Crystallogaphy

The subjects selected for consideration during the Second General Assembly and International Congress of the Union to be held in Stockholm from 27th June to 3rd July, 1951, are: Instruments and Measurements, New Developments in Structure Determination, Mineral Structures, Metal Structures, Inorganic Structures, Organic Structures, Proteins and Related Structures, Random and Deformed Structures, Thermal Transformations, Crystal Growth and Neutron Diffraction.

The Executive Committee has decided that no report of the Congress shall be published, it being felt that most of the contributions will find their way into the scientific literature in the normal manner and that the expense of separate publication would not be warranted. Full abstracts of the contributions will, however, be distributed in advance; speakers will then be expected to present their papers quite briefly at the Congress in order that ample time may be available for discussion.

It is proposed to hold two Symposia on the following topics: Advanced techniques in Structure Determination; Electron Diffraction in Liquids and Gases. These Symposia are intended primarily for specialist workers in these fields, but in so far as accommodation is available all crystallographers will be welcome. The Symposia will probably be held on the days immediately following the Congress, but one or more sessions may also be arranged during the period 27th June-3rd July. Copies of the Second Circular (September 1950) containing further details, can be had from the General Secretary of the Union, R. C. Evans, Crystallographic Laboratory, Cambridge, England, or

from the Secretary to the Government of India, Department of Scientific Research, North Block, Central Secretariat, New Delhi.

Zoological Society of Bengal

At the Fourth Annual General Meeting of the Society held on August 20, 1950, the following were elected officers and members of Council:—

President : Prof. H. K. Mookerjee, D.Sc., F.N.I. ; *Vice-Presidents* : Dr. M. O. P. Iyengar, D.Sc. and Sri. D. D. Mukherji, M.Sc. ; *Hony. Treasurer* : Sri. M. M. Chakravarty, M.Sc. ; *Hony. Secretary*: Sri. G. K. Chakravarty, M.Sc.

Longest and Shortest Times

The element tellurium 130, formerly thought to be completely stable, has been found by scientists at the Argonne National Laboratory in Chicago to be radioactive with a half-life of about 1½ sextillion years, or about 500 billion times longer than the estimated age of the earth; evidently only an infinitesimal part of the earth's original tellurium has had time to decay.

Tellurium's radioactivity is of a rare type known as double-beta transition, in which two negative electrons are emitted simultaneously from the nucleus of the atom involved. No change in atomic weight occurs and the tellurium becomes xenon 130, a rare gas. The Atomic Energy Commission reports that the longest known half-life was discovered from an excess of xenon 130 in samples of tellurium.

At the other extreme, the same report tells of a half-life of only one tentrillionth of a second for the neutral meson, which "decays almost as soon as it is formed into two high energy gamma rays," a discovery made at the radiation laboratory of the University of California. The measured half-life of the neutral meson is so short that light itself travels only about one-thousandth of an inch in that time.

(*By courtesy of "Sky and Telescope", August 1950, Pp. 249.*)

ERRATA

Vol. 19, No. 8, page 233: Note on "A Large Sample Method of Estimating Unemployment in Large Cities".

Equation (5): *for* $Y^2 \left(\bar{x}^2 - \dfrac{u^2 \sigma_x^2}{n} - \right.$

read $Y^2 \left(\bar{x}^2 - \dfrac{u^2 \sigma_x^2}{n} \right) -$

Line 6 from the bottom: *for* $\dfrac{\bar{u}}{z} \triangle z$.

read $\dfrac{\bar{u}}{z} \triangle Z$.